Syllabus for EEL 3923C Design I Spring 2021

1. Catalog Description

Preparatory skills are developed for Design II. The main focus is in basic hardware design, software implementation, microprocessor and microcontroller development tool usage, and PCB design tools. Student design, produce and report on a hardware prototype, meeting defined specifications and using a structured design methodology. Project management, hardware prototyping, project reporting. Laboratory. Credits 3.

2. Pre-requisites

EEL 3111C, EEL 3701C

(EEL 4744C, EEL 3308, EEL 3112 recommended as co-requisites)

3. Course Objectives

Students will reinforce basic circuit techniques and digital systems to implement electrical and/or computer engineering projects. PCB design software will also be taught such that small PCBs can be fabricated and tested in the lab. Each of the previously mentioned tools sets form a basic design module where they are introduced and then tested via short projects in the lab. At the end of the semester, a design project is assigned that uses the modules taught earlier in the semester.

4. Contribution of course to meeting ABET professions Component

-One semester of engineering topics (e.g., analog and digital design, PCB design)

5. Relationship of course to ABET program outcomes

- An ability to design a system, component, or process to meet desired needs (design projects)
-An ability to identify, formulate and solve engineering problems (module and design project)

6. Instructors/coordinators:

	Dr. Allen Turner	**Mike Stapleton**
Office Location	NEB 227	NEB 239
Office Hours	TBD	TBD
Telephone	392-2652	392-2727
Email	turneral@ufl.edu	mstap@ece.ufl.edu
Website	http://lss.at.ufl.edu	

7. Teaching assistants

Lab TA's contact information and office hours to be posted on the website

Design I Lab:	NEB 246	392-9952

The TA's will be available to assist students in the Design I lab during their office hours. They will also assist with grading, evaluation of student modules and final projects, and with operating the labs.

7a. Technical Support:

Mr. Eric Liebner, Engineer
236 NEB

8. Meeting Times

Lab/TA hours: See website

9. Meeting Location

TBD

10. Material and Supply Fees

$153.00

11. Laboratory Schedule

To be posted on the course website

12. Textbooks and Software Required

a. No textbook
b. LTSPICE IV: Available for free at http://www.linear.com/designtools/software/
c. MSP430, Atmel & Pic microprocessor development tool software and Altium PCB design software will be made available to the students in lab.

13. Micro Controller or Measurement Computing MCCDAQ

Students who have completed, or are taking, either 3744C or 4744C must use a microcontroller for the two microcontroller modules and for the final project.

Otherwise, students have the option of either using a microcontroller or using a Measurement Computing MCCDAQ USB controller, to complete the microcontroller modules and the final project.

Students using the MCCDAQ

1. Must meet the full performance requirements for the Ohm Meter module.
2. Will complete the function generator module with the following modifications.
   a) Will use bit banging rather than SPI to interface to the 1661 Digital to Analog Converter
   b) Will vary frequency from 1 to 5 Hz on one 1661 channel
   c) Will use the second 1661 channel to vary the contrast on the LCD through the use of two push button switches.
   d) Will not be required to drive a speaker.

14. Course Outline

		Group 1 TR	*Group 1 MWF*	*Group 2 TR*	*Group 2 MWF*	*Group 3 TR*	*Group 3 MWF*	*Group 4 TR*	*Group 4 MWF*
Date	*Day*	*Topic*	*Topic*	*Topic*	*Topic*	*Topic*	*Topic*	*Topic*	*Topic*
1/11	M	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts	Syllabus, Introduction to Design, Ethics Test and Measurement Module Starts
1/12	T	Elementary Pre-Amplifier Design	Elementary Pre-Amplifier Design	PCB Design Using the Altium Suite	PCB Design Using the Altium Suite	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	Power Supply Design & Construction T&M Module	Power Supply Design & Construction T&M Module
1/13	W	Pre-Amp	Pre-Amp	PCB Design	PCB Design	µ-Controller	µ-Controller	Power Supply	Power Supply
1/14	R	Pre-Amp	Pre-Amp	PCB Design	PCB Design	µ-Controller	µ-Controller	Power Supply	Power Supply
1/15	F	Pre-Amp	Pre-Amp	PCB Design	PCB Design	µ-Controller	µ-Controller	Power Supply	Power Supply
1/18	M	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day
1/19	T	Pre-Amp	Pre-Amp	PCB Design	PCB Design	µ-Controller	µ-Controller	Power Supply	Power Supply
1/20	W	Pre-Amp	Pre-Amp	PCB Design	PCB Design	µ-Controller	µ-Controller	Power Supply	Power Supply
1/21	R	Pre-Amp	Power Supply Design & Construction	PCB Design	PCB Design	µ-Controller	µ-Controller	Power Supply	Power Supply
1/22	F	Power Supply Design & Construction	Power Supply	Elementary Analog Filter Design	PCB Design	µ-Controller	µ-Controller	PCB Design	Power Supply
1/25	M	Power Supply Test and Measurement Deadline	Power Supply Test and Measurement Deadline	Elementary Analog Filter Design Test and Measurement Deadline	PCB Design Test and Measurement Deadline	µ-Controller Test and Measurement Deadline	µ-Controller Test and Measurement Deadline	PCB Design Test and Measurement Deadline	PCB Design Test and Measurement Deadline
1/26	T	Power Supply	Power Supply	Analog Filter	Elementary Analog Filter Design	µ-Controller	µ-Controller	PCB Design	PCB Design
1/27	W	Power Supply	Power Supply	Analog Filter	Analog Filter	PCB Design Using the Altium Suite.	µ-Controller	PCB Design	PCB Design
1/28	R	Power Supply	PCB Design Using the Altium Suite.	Analog Filter	Analog Filter	PCB Design	PCB Design Using the Altium Suite.	PCB Design	PCB Design
1/29	F	PCB Design Using the Altium Suite.	PCB Design	Analog Filter	Analog Filter	PCB Design	PCB Design	PCB Design	PCB Design
2/1	M	PCB Design	PCB Design	Analog Filter	Analog Filter	PCB Design	PCB Design	PCB Design	PCB Design
2/2	T	PCB Design	PCB Design	Analog Filter	Analog Filter	PCB Design	PCB Design	PCB Design	PCB Design
2/3	W	PCB Design	PCB Design	Elementary Pre-Amplifier Design	Analog Filter Design	PCB Design	PCB Design	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	PCB Design
2/4	R	PCB Design	PCB Design	Pre-Amp	Elementary Pre-Amplifier Design	PCB Design	PCB Design	µ-Controller	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)
2/5	F	PCB Design	PCB Design	Pre-Amp	Pre-Amp	Interfacing a Serial D/A to a Micro-controller	PCB Design	µ-Controller	µ-Controller

2/8	M	PCB Design	PCB Design	Pre-Amp	Pre-Amp	Serial D/A	PCB Design	µ-Controller	µ-Controller
2/9	T	PCB Design	Elementary Analog Filter Design	Pre-Amp	Pre-Amp	Serial D/A	Interfacing a Serial D/A to a Micro-controller	µ-Controller	µ-Controller
2/10	W	Elementary Analog Filter Design	Analog Filter	Pre-Amp	Pre-Amp	Serial D/A	Serial D/A	µ-Controller	µ-Controller
2/11	R	Analog Filter	Analog Filter	Pre-Amp	Pre-Amp	Serial D/A	Serial D/A	µ-Controller	µ-Controller
2/12	F	Analog Filter	Analog Filter	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	Pre-Amp	Serial D/A	Serial D/A	µ-Controller	µ-Controller
2/15	M	Analog Filter	Analog Filter	µ-Controller	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	Serial D/A	Serial D/A	µ-Controller	µ-Controller
2/16	T	Analog Filter	Analog Filter	µ-Controller	µ-Controller	Serial D/A	Serial D/A	µ-Controller	µ-Controller
2/17	W	Analog Filter	Analog Filter	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Interfacing a Serial D/A to a Micro-controller	µ-Controller
2/18	R	Analog Filter	Analog Filter	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Serial D/A	Interfacing a Serial D/A to a Micro-controller
2/19	F	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	Analog Filter	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Serial D/A	Serial D/A
2/22	M	µ-Controller	Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Serial D/A	Serial D/A
2/23	T	µ-Controller	µ-Controller	µ-Controller	µ-Controller	Serial D/A	Elementary Pre-Amplifier Design	Serial D/A	Serial D/A
2/24	W	µ-Controller	µ-Controller	µ-Controller	µ-Controller	Elementary Pre-Amplifier Design	Pre-Amp	Serial D/A	Serial D/A
2/25	R	µ-Controller	µ-Controller	µ-Controller	µ-Controller	Pre-Amp	Pre-Amp	Serial D/A	Serial D/A
2/26	F	µ-Controller	µ-Controller	µ-Controller	µ-Controller	Pre-Amp	Pre-Amp	Serial D/A	Serial D/A
3/1	M	µ-Controller	µ-Controller	µ-Controller	µ-Controller	Pre-Amp	Pre-Amp	Serial D/A	Serial D/A
3/2	T	µ-Controller	µ-Controller	µ-Controller	Interfacing a Serial D/A to a Micro-controller	Pre-Amp	Pre-Amp	Serial D/A	I2C Timer Module
3/3	W	µ-Controller	µ-Controller	Interfacing a Serial D/A to a Micro-controller	Serial D/A	Pre-Amp	Pre-Amp	Stepper Motor	I2C Timer Module
3/4	R	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Pre-Amp	Power Supply Design & Construction	Stepper Motor	I2C Timer Module
3/5	F	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Power Supply Design & Construction	Power Supply	Stepper Motor	I2C Timer Module
3/8	M	µ-Controller	µ-Controller	Serial D/A	Serial D/A	Power Supply	Power Supply	Stepper Motor	I2C Timer Module

3/9	T	µ-Controller	Interfacing a Serial D/A to a Micro-controller	Serial D/A	Serial D/A	Power Supply	Power Supply	Stepper Motor	I2C Timer Module
3/10	W	Interfacing a Serial D/A to a Micro-controller	Serial D/A	Serial D/A	Serial D/A	Power Supply	Power Supply	Stepper Motor	I2C Timer Module
3/11	R	Serial D/A	Serial D/A	Serial D/A	Serial D/A	Power Supply	Power Supply	Stepper Motor	I2C Timer Module
3/12	F	Serial D/A	Serial D/A	Serial D/A	Serial D/A	Power Supply	Power Supply	I2C Timer Module	I2C Timer Module
3/15	M	Serial D/A	Serial D/A	Serial D/A	Serial D/A	Power Supply	Power Supply	I2C Timer Module	Stepper Motor
3/16	T	Serial D/A	Serial D/A	Serial D/A	Power Supply Design & Construction	Power Supply	Elementary Analog Filter Design	I2C Timer Module	Stepper Motor
3/17	W	Serial D/A	Serial D/A	Power Supply Design & Construction	Power Supply	Elementary Analog Filter Design	Analog Filter	I2C Timer Module	Stepper Motor
3/18	R	Serial D/A	Serial D/A	Power Supply	Power Supply	Analog Filter	Analog Filter	I2C Timer Module	Stepper Motor
3/19	F	Serial D/A	Serial D/A	Power Supply	Power Supply	Analog Filter	Analog Filter	I2C Timer Module	Stepper Motor
3/22	M	Serial D/A	Serial D/A	Power Supply	Power Supply	Analog Filter	Analog Filter	I2C Timer Module	Stepper Motor
3/23	T	Serial D/A	Serial D/A	Power Supply	Power Supply	Analog Filter	Analog Filter	I2C Timer Module	Stepper Motor
3/24	W	Serial D/A	Serial D/A	Power Supply	Power Supply	Analog Filter	Analog Filter	I2C Timer Module	Stepper Motor
3/25	R	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
3/26	F	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
3/29	M	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
3/30	T	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
3/31	W	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/1	R	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/2	F	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/5	M	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/6	T	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/7	W	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/8	R	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/9	F	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/12	M	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/13	T	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/14	W	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/15	R	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/16	F	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/19	M	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/20	T	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project
4/21	W	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project	Final Project

Test and Measurement Module

Each student must individually demonstrate their ability to fully utilize the capabilities of the lab equipment to a TA including the power supply, function generator and oscilloscope. This module runs simultaneously with another module for each group. The Test and Measurement Module is due at 5 PM on January 25th.

Elementary Pre-Amplifier Design

Day 1- Elementary Split & Single supply OpAmp design for low gain audio bandwidth applications. Design, build, test and demonstrate an amplifier with specific performance criteria.
Day 2-In lab/class experimentation. Continue LT Spice tutorial and review breadboards, power supplies, components, signal generators, and digital scopes
Day 3-Begin assignment check-off process.
Day 4-End assignment check-off

Power Supply Design & Construction

Day 1-Rectifying AC Power, voltage regulation, diode/capacitor/regulator functionality. Design, build, test and demonstrate a power supply with specific performance criteria.
Day 2-In Lab/class experimentation.
Day 3-Begin assignment check-off process.
Day 4-End assignment check-off.

PCB Design Using the Altium Suite

Day 1-Introduction to Altium software and PCB design. Tutorials will be posted online and the assignment will be to hand route a simple circuit as well as create the required gerber files and go through the submission process for our in lab milling PCB.
Day 2-Continue the Altium PCB design lecture as was done in the past.
Day 3-Lab milling machine submission & checking (TAs).
Day 4-PCB check-off process.
Day 5-PCB check-off process.

Elementary Analog Filter Design

Day 1-Basic Audio Analog Filter design. Design, build test and demonstrate an active bandpass filter with specific performance criteria.
Day 2-In lab/class experimentation.
Day 3-In Lab/class experimentation.
Day 3-Begin assignment check-off process.
Day 4-End assignment check-off.

Basic Micro-Controller Applications (I/O, LCD, Interface, A/D)

Day 1-Basic Micro-Controller applications assignment part 1 which consists of blinking an LED with an I/O port pin.
Day 2-Basic Micro-Controller applications assignment part 2. Design and build an Ohm meter utilizing a micro-controller based A/D converter to measure resistance and display the results on an LCD. ‘C’ functions for the LCD interface will be available for each Micro-controller type. Introduction to A/D converters and ‘C’ code to use these onboard devices will be available for each micro-controller.
Day 3-Blink LED assignment check-off process.
Day 4-In lab experimentation
Day 5-Begin LCD & A/D assignment check-off process.
Day 6-End LCD & A/D assignment check-off process.

Interfacing a Serial D/A to a Micro-controller

Day 1-Provide the assignment which consists of connecting a serial D/A to a micro-controller handed out earlier and generating sine, square, triangle and sawtooth waveforms with variable frequency and amplitude.
Day 2-In lab experimentation
Day 3-In lab experimentation
Day 4-In lab experimentation
Day 5-Begin D/A assignment check-off process.
Day 6-End D/A assignment check-off process.

Group 4 Module 5

Day 1-Provide the assignment which consists of measuring two inputs and displaying their values utilizing the stepper motor pair. One input will be a digital pulse stream corresponding to velocity in miles per hour. The number of pulses per second corresponds to the velocity in miles per hour. The second input will be an analog voltage representing the fuel remaining. 0V corresponds to empty and 5V corresponds to full and the voltage varies linearly between those two extremes. In addition to providing an analog output via the stepper motor pair the system must also provide an LED output when less than 10% of fuel remains.
Day 2-In lab experimentation
Day 3-In lab experimentation
Day 4-In lab experimentation
Day 5-Begin D/A assignment check-off process.
Day 6-End D/A assignment check-off process.

Group 4 Module 6

Day 1-Provide the assignment which consists of utilizing the I^2C timer module to implement an alarm clock. The system must provide a means to set the time, set an alarm time and have a digital audio output when an alarm condition occurs. The I^2C module must be utilized for all timing functions.
Day 2-In lab experimentation
Day 3-In lab experimentation
Day 4-In lab experimentation
Day 5-Begin D/A assignment check-off process.
Day 6-End D/A assignment check-off process.

Final Project

Day 1 -Final project design, build and testing. The final project will include required design elements for the given product specification. The design (circuit) should be created using the Altium software and the auto-router may be employed to generate the PCB. The PCB should then be realized via our milling equipment or some external professional PCB manufacturer. i.e. Advanced Circuits, Inc.
Day 2-In lab experimentation.
Day 3-In lab experimentation
Day 4-In lab experimentation.
Day 5-In lab experimentation
Day 6-In lab experimentation
Day 7-In lab experimentation

Day 8-In lab experimentation
Day 9-In lab experimentation
Final project evaluation
Final project evaluation

15. Attendance and Expectations

a. Format: The course is comprised of seven modules and a final project. The class is broken into 8 groups with each group following a different schedule. Over the course of the term all groups will complete the same modules, however, they will be required to complete the modules according to the schedule as shown in item 14 above. All module presentations for each group are due at 5PM on the last day listed for that module for that group. Module write-ups are due at 5PM two weekdays after the group presentation deadline for that module. The assignments and supporting material will be available on canvas.

Students must submit ***individual*** work ***individually*** on each module/final project. You are encouraged to work together and share ideas on assignments. However you are not allowed to copy or duplicate anything, from anyone or any source. This work will be considered cheating and will be dealt with in a severe manner. See Section 19 on Honesty Policy.

c. Class and Laboratory etiquettes: It is understood that attendees at lectures and labs will be focused on the particular lecture or lab and will take every possible measure to minimize distractions for everyone (i.e. no newspapers, no cell phones, no PDAs, no iPODS, no laptops, etc. unless instructed to use them for class, no newspapers, on-time attendance, and no early departures (unless noted and approved in advance)).

It is the student's responsibility to return all equipment and clean her/his work area before leaving the Lab unless the equipment is specifically checked out. In the latter case the equipment must be checked in before the end of the semester.

16. Grading-methods of evaluation

The overall grade for the course will be based on Seven Modules and a Final Project.

a. Seven Modules

1. The modules are pass/fail.
2. Each student will be allowed to use up to two tardy passes during the term.
    a. The use of a tardy extends the due date for that module by one week.
    b. Students may use excess tardies beyond the two tardy passes.
        i. Each excess tardy will result in a reduction in the final grade for the course to the next lower grade. i.e. two excess tardies would reduce an 'A' first to an 'A-' and then to a 'B+'.
3. Students are encouraged to NOT USE THE TARDY PASSES so that they will be available if they need them later.
4. There will be a full letter grade deduction for the final grade for each module that was not fully completed. Full completion requires a pass on the demonstration AND a pass on the associated write-up.

b. Final project

The final project will be graded on a 100 point scale. To pass the course the final project must be implemented on a PCB designed by each student, AND, the PCB must have been designed, and intended, to fully implement the entire functionality of the system. A final project that works properly, but meets only the minimum requirements, will receive a score no higher than 90.

17. Grading Scale

Grading scale for final project: ≥93 A, ≥90 A-, ≥83 B, ≥80 B-, ≥ 73 C,≥ 70 C-,≥ 63 D, ≥ 60 D-,<60 E

The final grade for the course will be determined by reducing the final project grade by any letter grade reductions due to failing to fully complete any of the modules and/or for the use of excess tardies.

18. Make-up Exam Policy

a. For the pass/fail evaluation of each module, students are allowed two tardy passes where a tardy is any module checked-off after the initial scheduled time. The tardy extension can be up to one week only and if a student falls too far behind they will be strongly encouraged to drop the class. After the first two free tardy extensions are used, additional tardy extensions result in a partial grade penalty. i.e. A=>A-…C-=>D+, one grade lower automatically per unsanctioned tardy.

19. Honesty Policy

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. Accommodation for Students with Disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services

Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.

SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.

Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.

Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

22. Software Use

All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.