

# EEL 3744C: MICROPROCESSOR APPLICATIONS

<http://mil.ufl.edu/3744/> @eel3744 UF's Canvas

**INSTRUCTORS** Dr. Eric M. Schwartz MAEB 321 392-2541 ems@ufl.edu Office Hours: Wed: 12:50pm, Fri 1:55pm

**LECTURES** Tues 2<sup>nd</sup> - 3<sup>rd</sup> (8:30-10:25am) & Thur 3<sup>rd</sup> (9:35-10:25am) in LAR 330

**LAB SECTIONS**  
(NEB 281)

1E83 M 6th-8th (Khaled) .	8705 M E1-E3 (Daniel) .	1539 T E1-E3 (Khaled) .
1540 W 9th-11th (Madison) .	2B04 W E1-E3 (Khaled) .	6957 R E1-E3 (Daniel) .

**CATALOG DESCRIPTION**

Elements of microprocessor-based systems; hardware interfacing and software design for their application. Laboratory.

**COURSE OBJECTIVES** (ABET Design Content 50%) [Lab fee: \$198.20]

**Official:** Experience in the elements of microprocessor-based systems, hardware interfacing and software design for their application. Laboratory.

**Actual:** Students learn the functional and technological characteristics of microprocessor structures, memory components, peripheral support devices, and interface logic. Through laboratory experiments and examples, students learn how to integrate and apply microcomputer subsystems and components to common interfacing problems. Although the Atmel ATxmega128A1U microcontroller will serve as the vehicle for exploring these topics, students gain the experience to generalize the concepts to other microprocessors.

## TEXTBOOKS

F. Cady, *Microcontrollers and Microcomputers Principles of Software and Hardware Engineering*, Second Edition, Oxford University Press, New York, NY, 2009, ISBN13: 9780195371611, ISBN10: 0195371615. See <http://tinyurl.com/3744-ufl>.

## REFERENCES

- H. Lam & A. Arroyo, *Fundamentals of Computer Engineering*, Univ. Copy Center, Gainesville, FL 1995.
- Gene H. Miller, *Microcomputer Engineering—2<sup>nd</sup> edition*, Prentice-Hall, New Jersey, 1999.
- J. Peatman, *Design with Microcontrollers*, McGraw Hill, New York, 1988.
- K. Doty, *Fundamental Principles of MicroComputer Architecture*, Matrix Publishers, Inc., Oregon, 1979.

## OFFICE HOURS

You may go to any TA available, not just the one teaching your lab section. The instructors will hold office hours (as shown above) or by appointment. If you come by at any other time, I reserve the right to say, "I'm busy," although I rarely say this (even though it is invariably true). You are encouraged to use e-mail to communicate with the instructor and TAs.

### TA Office hours in NEB 281 (or NEB 222, when NEB 281 is not available)

TA name	Khaled Hassan	Madison Emas	Daniel Gonzalez
office hours	M,W,F: 3 <sup>rd</sup> ; W: 6 <sup>th</sup> ; R: 9 <sup>th</sup> -10 <sup>th</sup>	M,W: 4 <sup>th</sup>	T: 6 <sup>th</sup> -7 <sup>th</sup> ; R: 7 <sup>th</sup> -8 <sup>th</sup>
e-mail	<a href="mailto:khaledjhassan@ufl.edu">khaledjhassan@ufl.edu</a>	<a href="mailto:madisel@ufl.edu">madisel@ufl.edu</a>	<a href="mailto:danngonz3@ufl.edu">danngonz3@ufl.edu</a>

## MULTIMEDIA CLASS/AUDIENCE NOTES

Audience notes are normally posted on the class web site every week or so for the subsequent week or more of classes. The notes consist of pdf versions of the class PowerPoint slides with some space for note taking. These notes are not required but are **highly** recommended. Check the class web site for information on exactly when the notes are available. **For optimal performance**, read the notes and examples for a class **before** that class and bring the **printed class notes and examples** to class to augment the printed material with your own notes. Notes will be removed shortly after they are covered in class.

## EXAM SCHEDULE

All exams (except exam 3a) will be given outside of regular class time..

### Exam Schedule

EXAM	DATE	TIME	LOCATION
1	Mon, 10 Oct	5:10pm	_____
2	Tues, 8 Nov	5:10pm	LIT 121
3a	Tues, 6 Dec	8:30am	LAR 330
3b	Wed, 7 Dec	5:10pm	LIT 121

## HARDWARE PURCHASES

- The *National Instruments (NI) Analog Discovery 2 (NAD) board* or *Digilent Analog Discovery 2 (DAD) board* is required for this course (and many other ECE courses). Board ordering information for the NAD can be found at <http://tinyurl.com/NAD-UF-f16> and the DAD-2 at <http://tinyurl.com/DAD-UF-f16>. When purchasing the NAD, other discounted items can be found on the same website. If you are an EE student, I also recommend that you obtain the NI Multisim software (for analog circuit design and simulation). The UF bookstore has the NAD available, for those that want to use financial aid or want it right away. (I was told that they have the NAD for \$199.)
- Soldering Iron [purchases optional, but recommended]. We will have soldering irons in our lab.
- Wire cutters and needle-nosed pliers [purchases optional, but recommended]. A few of each may be available in lab.
- UF 3744 (AVR XMEGA) board kit [required] was designed by *Out of the Box: Electronics and Robotics*, <http://ootbrobotics.com/>. The 3744-board kit is now included in your lab fees. Your parts kit comes with two printed circuit boards (PCBs) – the uPAD (with a ATxmega128A1U already mounted on the board) and the uPAD Proto Base (with a large prototyping area). You will get dozens of parts including RAM, 2 USB cables, LCD Panel, and many sockets and other components. **You probably cannot buy the kits separately, so please be careful as you design and construct your circuits this semester.**

*Radio Shack*, *Lowe's*, and *Home Depot* all sell soldering irons. *Radio Shack* has several cheap and adequate soldering irons, for example part numbers 640-2055, 640-2051, and 640-0094 (for \$12.99, \$8.99, and \$22.99, respectively). *Jameco.com* also has many soldering irons, starting at \$19 when shipping is included. *Weller* makes the recognized best soldering irons, e.g., WLC100 is a very good iron available for about \$45.

You **MUST** have and use your own laptop for this course, since there are no computers available in the 3744 lab. You will be given your UF 3744 board kit in your first lab meeting (Lab 0). This kit contains most of the additional hardware that you will add to your boards over the course of the semester. (You may also need to purchase some additional ICs or other components as the semester progresses.) Starting with lab 1, you will need to wire-wrap.

## CLASS ATTENDANCE AND BEHAVIOR

Class attendance is mandatory and **all** classes are important. There may be pop (unannounced) quizzes. A missed class/quiz cannot be made up.

Turn off all cell phones, beepers, laptop sound effects, and other noise making devices before entering our classroom. If a noise-making device goes off during class, I reserve the right to lower your course grade. If a noise-making device goes off during an exam, you will lose a significant number of points on this exam.

## SOFTWARE REQUIREMENTS

*Atmel Studio*, an integrated development environment (IDE) for developing and debugging Atmel ARM® Cortex™-M processor-based and Atmel AVR® microcontroller applications (including our XMEGA), will be utilized in our course.

*Quartus* (from Altera) has been now required for *EEL 3701C* and *EEL 4712C*, so many of you already have copies. Quartus Web Edition Version 9.1, Service Pack 2 is available to download, free of charge from Altera's website and our website. Some *EEL 3744C* homework and laboratory assignments will require the drawing or simulation of logic circuits. This program greatly simplifies such assignments. Since Quartus programs will be useful in other *ECE* courses (*EEL 4712*, *EEL 4713* and *Senior Design*), we recommended that you obtain a copy if you have not already done so. If you have an old version of Quartus, it should work fine. Newest versions have restored the built-in simulator. You will need your Altera USB Blaster from 3701 in order to program a CPLD on the UF 3744 (uPAD Proto Base) PCB.

## REFERENCE MANUALS (available on our class website)

- [XMEGA AU Manual](#) (Atmel doc8331)
- [XMEGA128A1U Manual](#) (Atmel doc08385)
- [Instruction Set](#) (Atmel doc0856)
- and others

Do **NOT** printout these entire documents. Selected pages should be printed and brought to class, lab, and exams. Other documents are available on the class website (<http://mil.ufl.edu/3744/software.html>) and on the Atmel website (<http://www.atmel.com/devices/ATXMEGA128A1U.aspx?tab=documents>).

## COURSE GRADE DETERMINATION

I have found that attendance is directly correlated to grades. I assumed previously that students in 3744 had learned this already, but this is apparently not the case. Therefore, attendance is required, but it will **NOT** be worth positive points. Each missed class for which I take role (which will be done **randomly**) will result in a deduction of 1 point (out of 100) from your overall course total. There are no excuses for missed classes, but two classes can be missed without penalty. (Late arrival or early departure will count as an absence.)

All grades are **non-negotiable one week** after the grade is posted. Please don't come to me after the final grades have been posted with a hard-luck story.

3 Midterm Exams	62–73%	(Exams are equally weighted)
Laboratory	25%*	(Some labs will count as less than 1 lab, some as a 1 lab, and some as more than 1 lab)
Homework	2–3%†	(4-10 homework)
(Pop) Quizzes	0–5%	(0-10 quizzes)
Total	100%	(90+ on exam 3 results in 5% grade bonus, e.g., 86% $\Rightarrow$ 91%)

\* A grade of 65% or better in Lab is **required** in order to obtain a passing grade. Your lowest lab will be dropped. But use this drop wisely, i.e., do **not** just skip a lab since all labs are important and your next missed lab may be unavoidable. If you need to miss a single lab, it's ok; you can **not** make up the missed lab. (You should do this lab on your own.) **If you have a valid reason for missing this lab, get documentation for your first missed lab and hold on to it.** If you miss a **second** lab, you must show the **professor** (not the TA) **written documentation for BOTH your first and your second missed labs.** This documentation should be official, i.e., from a doctor, judge, etc., so that a make-up can be arranged. You must notify Dr. Schwartz **prior** to your scheduled second missed lab or **as soon as possible after** your second missed lab. **There is no excuse that will allow you to reschedule your first missed lab other than an assembly exam in another course.** You must notify the professor at least 8 days prior to your assembly exam.

† Although HW does not count much toward your grade, **not** doing it will likely have an effect on your quiz and exam scores.

## GRADING POLICY

UF grades are often distributed according to the following **rough** distribution: A: 10% B: 35% C: 45% D&E: 10%. This usually works out to mean that if you make class average you will earn close to a “C+” or “B-”. If you score 10 percent above the class average, you will probably earn a “B.” If you score 20 percent above class average, you will probably earn an “A.” **This is not a contract on grading.** Rather, this information serves to provide you a rough understanding of your academic standing at any time during the semester. Grades are periodically posted on the class web site. **It is your responsibility to check your grades regularly** since mistakes often happen when dealing with a large number of students and TAs. **All grades are final one week after posting.** After curving exams as needed, course grades are assigned using the 60 (D), 70 (C), 80 (B), and 90 (A) cuts. [86.6  $\rightarrow$  89.9 (A-), 83.3  $\rightarrow$  86.6 (B+), 76.6  $\rightarrow$  79.9 (B-), 73.3  $\rightarrow$  76.6 (C+), 66.6  $\rightarrow$  69.9 (C-), 63.3  $\rightarrow$  66.6 (D+), 0<59.9 (E)].

Part of your grade on tests, quizzes, labs, etc. is based not only on solving the problem you are presented with, but the manner in which you solve it. For example, there is a difference between two programs that meet the given specifications, but one is an elegant, extensible 20-line solution, while the other is an obfuscated 100-line program that also meets the specifications but would be difficult to extend later. Just as your future employer would value the latter program less than the first, so will I in grading your assignments.

The UF grading policies for assigning grade points can be found on the following undergraduate catalog web page: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

## COURSE REQUIREMENTS

1. Perform all laboratory experiments. A grade of 65% or better in Lab is **required** in order to obtain a passing grade. Your lowest lab will be dropped. But **use this drop wisely**, i.e., do **not** just skip a lab since all labs are important and your next missed lab may be unavoidable. If you need to miss a single lab, it's ok; you can **not** make up the missed lab. (You should do this lab on your own. If necessary, you may visit a TA during an office hour for help.) **If you have a valid reason for missing this lab, get documentation for your first missed lab and hold on to it.** If you miss a **second** lab, you must show **Dr. Schwartz** (not a TA) **written documentation for BOTH your first and your second missed labs.** This documentation should be official and from a doctor, judge, etc., so that a make-up can be arranged. You must notify the professor **prior** to your scheduled second missed lab or **as soon as possible after** your second missed lab. **There is rarely an excuse that will allow you to reschedule your first missed lab other than an exam in another course.** You must notify the **Dr. Schwartz** at least **8 days** prior to your exam (or other) so that an alternate lab time might be arranged.

- If you believe that you have valid university-related reason for missing a particular lab (e.g., Lab X), send an email to Dr. Schwartz with the following information (with subject: **3744: Conflict with Lab X**, where X is the lab number).
  - State the cause for missing your Lab X and provide associated documentation for this event.
  - Provide a list of each of the Lab X days and periods for which you have no conflict and could attend.
  - If this is for an exam in another course, **first** verify that there are no alternate exam times available. If none, then provide Dr. Schwartz (via email, with subject: **3744: Conflict with Lab X**, where X is the lab number) the course number and name, and also your teacher's name, email, and phone number.

All grades are **non-negotiable one week** after the grade is assigned. Please don't come to me after the final grades have been posted with a hard-luck story.

- Labs **must** be done at scheduled times (except as described above).
  - Students **must** be prepared to demo their lab when they enter. Students will be randomly selected for their demonstration times during their lab period.
  - An average lab grade of **65% or higher** is required to be **eligible** to **pass** the class!
2. Do all homework assignments and turn them in **through Canvas before** the time that they are due.
    - **Late homework will not be accepted.**
  3. A quiz can happen at any time, during any class, i.e., quizzes are generally not announced ahead of time.
    - **Missed quizzes cannot be made up.**
  4. Take **3** during-term exams. (Note that exam 3 is broken up into two parts and that there is **NO** final exam.)
    - **No makeup exams or test will be given except in cases of a medically documented incapacity or family emergency.**

## RECOMMENDATION

It is recommended that you bring your laptop or tablet computer (or printed notes) to each class, so that you can easily augment these notes with your own notes. Historically, student that take good notes perform much better in this class than those who do not take notes (or take poor notes).

## STUDENTS REQUIRING ACCOMMODATIONS

The University of Florida is committed to providing academic accommodations for students with disabilities. Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, a student should present his/her accommodation letter to me supporting a request for accommodations. The University encourages students with disabilities to follow these procedures as early as possible within the semester.

Students requesting classroom, laboratory or exam accommodations must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. For optimal consideration, you must see the professor **during the first week of classes**.

## UF COUNSELING SERVICES (HEALTH AND WELLNESS)

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

- University Counseling & Wellness Center, <http://www.counseling.ufl.edu>, 3190 Radio Road, (352) 392-1575.
- SHCC mental Health, Student Health Care Center, <http://shcc.ufl.edu/>, Infirmary Building, 1 Fletcher Drive, 392-1161.
- U Matter, We Care, <http://www.umatter.ufl.edu/>, umbrella organization for UF's caring culture and provides students in distress with support.

### U Matter, We Care

- Your well-being is important to the University of Florida. The *U Matter, We Care* initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need.
  - If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the *U Matter, We Care* Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The *U Matter, We Care* Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center.
  - Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.
- Resources for Sexual Violence, [http://www.umatter.ufl.edu/sexual\\_violence](http://www.umatter.ufl.edu/sexual_violence), Immediate Response/Advocacy 392-5648 or 392-1111; Medical Care from Student Health Care Center, 392-1161.
  - University Police Department, 392-1111 (or 9-1-1 for emergencies), <http://www.police.ufl.edu/>.
  - Career Resource Center, <http://www.crc.ufl.edu/>, Reitz Union, 392-1601, career development assistance and counseling.

## ACADEMIC RESOURCES

- E-learning technical support, <https://lss.at.ufl.edu/help.shtml>, 392-4357, Learning-support@ufl.edu..
- Career Resource Center, <http://www.crc.ufl.edu/>, 392-1601. Reitz Union. Career development assistance and counseling.
- Library Support, <http://cms.uflib.ufl.edu/ask>.
- Teaching Center, <https://teachingcenter.ufl.edu/>, 392-2010. Broward Hall. General study skills and tutoring.
- Writing Studio, <https://writing.ufl.edu/writing-studio/>, 846-1138, 302 Tigert Hall.
- Student Complaints Campus: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).
- Ombuds office, <http://www.ombuds.ufl.edu/>. Ombuds office exists to assist students in resolving problems and conflicts



## STUDENT PRIVACY

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments.

## COURSE EVALUATION

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

## 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.

## TECHNOLOGY

The use of cell phones and **every other** technology device is strictly prohibited during exams. All use of an electronic devices during an exam will be considered a violation of the student honor code (i.e., cheating). See the *Honesty Policy* section below for the minimum penalties that are incurred for all cases of cheating in our course. Laptop computer and tablets are welcome in class as long as they are used for class-related work. Surfing the web, checking email, making Facebook posts, etc., is strictly prohibited (**if distracting to others**) and will result in course grade deductions.

## COMMUNICATION

You are responsible for checking announcements and course-related postings on the class website and Canvas. Twitter is utilized for announcements, so you are also responsible for getting this information (either with a Twitter account or with software that creates and email or text message from tweets). You are also responsible for checking your UF email daily.

## EXTRA CREDIT

Extra credit is sometimes offered during class (or on the web, by tweet, or by email). The amount of extra credit given is at the discretion of the faculty member unless specifically stated with the extra credit opportunity.

## HONESTY POLICY

The following pledge is required for all work submitted for credit by University of Florida students: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” UF students are bound also by the *Honor Pledge* which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.”

**CHEATING WILL NOT BE TOLERATED.** We will actively search for cheaters; we have and will use excellent software to help us in the search. If you are caught, there will be no negotiations. You will earn a course grade penalty (often failure for the course) and get reported to the honor court. There are **no excuses and no exceptions**. You may talk to other students about assignments, but the final work **must** be your own. If you are caught cheating on **any** assignment (homework, lab, quiz, or exam, etc.), you **will** be prosecuted. A meeting with the instructor (and, possibly, the UF honor court) will determine penalties, none of which are desirable or pleasant (i.e., cheating in this course always results in notification to the honor court, often results in a failing grade in the course, and can possibly result in suspension or expulsion from the university). If you know someone is cheating, **it is your responsibility to report it**. For more information about cheating, the UF Honor code, and the consequences of academic dishonesty, please refer to <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>. If you have any questions or concerns, please consult with Dr. Schwartz.

## WORKING TOGETHER

You are encouraged to work with other students on assignments in a professional manner. Each person in the group should attempt to solve all problems **independently** and **only** then discuss the results with one's partner(s) to correct errors and resolve differences. Copying your partner's work constitutes cheating and should not be permitted. Matching your solution to your partner's, however, is acceptable, if, after independent study and work you are convinced your partner's solution is correct. All solutions should reflect your style of problem solving, even those you have changed to match your partner's solution. In other words, **verbatim copying or simple paraphrasing of your partner's solution is not an acceptable form of cooperative study**. Your name and your partner's name(s) must be on your assignments. You may **not** copy and submit old or new posted solutions as if they were your own.

Although you may **consult** with other students, TAs, or instructors for your assignments, you **must** do independent work. Consulting means **“seeking opinions or advice,” not** getting working solutions, programs, or designs, understanding them, and then modifying them to make them your own. The latter constitutes cheating (see above section). Working side-by-side to find a solutions, construct a program, or design in a group constitutes cheating. (Solving homework are good practice for

solving quizzes and exams, which are also **not** group activities.) **You should note that we have used and will continue to use software that can detect similar submissions.**

All grades are **non-negotiable one week** after the grade is assigned. Please don't come to me after the final grades have been posted with a hard-luck story.

### EXAM RE-GRADE POLICY

If you believe an error has been made on an exam score, you must make a written request to the instructor explaining where the misgrading or error occurred and why you think more credit is deserved. This request must be submitted **immediately at the end of the class in which the exam is returned**. If you do resubmit an exam, the instructor reserves the right to scrutinize and grade the **entire** exam more closely. This definitely places your current score at risk. Consequently, it is not advisable to resubmit an exam for re-grade unless a blatant grading error has been made. You **must** make it clear what writing you added to the exam (by clear indication, e.g., use a different color pen or pencil) after it was returned to you.

### EXAM SOLUTIONS, HW SOLUTIONS AND LAB SHELLS

We will post homework, lab, lab program shells and other class material on our class web site at: <http://mil.ufl.edu/3744/>, along with periodic postings of your grades and the class grade book statistics. Previous exams on the course material are also posted on our web site. Current exam solutions will be discussed and shown in class on the day the graded exam is returned to class, but will **not** be posted.

### HOMEWORK GRADING

You must submit homework is through Canvas by the assigned deadline. Unless other specified (sometimes additional files are requested), a **single pdf** document should be submitted for each homework. Scans are acceptable, but must be compressed and in a single document. *Fast Scanner* (available for Android and iPhone) is a cell phone app that works well. Unclear scans **will not** be accepted. Homework solutions are sometimes posted on our class web-site **before** they are due. It is **not** appropriate to copy the supplied solutions verbatim; this constitutes cheating. Homework will only be graded in a cursory fashion, i.e., Zen grading is used. The grades will be entered into the grade book as 0 (no significant effort or not submitted), 1 (half-hearted attempt) or 2 (significant attempt). The final course grades will be assigned with strict cuts between grades, but HW **could** push you above a cut. Also, the (pop) quizzes will come from the class material, the labs, **and** the homework. In addition, the exams will be partly based on the assigned homework. **Late homework will not be accepted.**

### LABORATORY GRADING

**You will not be admitted to the lab without a Summary document**, as described in the *Lab Rules and Policies*. Homework is due through Canvas submission by the assigned deadline. Unless other specified, a **single pdf** document should be submitted for each homework. (Sometimes additional files will be requested.) Scans are acceptable, but must be compressed and in a single document. *Fast Scanner* (available for Android and iPhone) is a cell phone app that works well. The *Summary* document and other files also **must** be submitted through Canvas **BEFORE** the start of your lab.

Each circuit diagram, VHDL file, and assembly language program, and list file must have your name included at the top. **ALL** Quartus simulations should be clearly annotated. Quartus files should be sent in a **Quartus archive file**.

Some labs will count more than other labs. Grading emphasis will be placed upon your producing well documented, well-structured programs and hardware designs that realize the functional requirements specified by the lab handout and the lab instructor. The remaining portion of your grade will result from observations by your lab instructor on such matters as your understanding of the lab, your lab techniques, your pre-lab preparation, your lab reports and your cooperation and compliance with the rules. Having your design perform properly does **not** guarantee a grade of 100, but makes a 100 grade **possible**. Lab designs and/or software that are similar and/or identical to other student's work constitute cheating (see above) and result in you failing the course, honor court charges, and possibly expulsion from UF. We have software that will be used to look for plagiarized software. There may be a quiz at the beginning of some labs. If you are late for a lab, you will get a zero for the quiz.

### HANDOUTS

Most handouts are supplied on-line and can be downloaded from the class web site: <http://mil.ufl.edu/3744/>. Old graded non-lab assignments not picked up in class can be picked up from Dr. Schwartz for a few days, then they will be recycled..

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## LABORATORY GUIDELINES

### LABORATORY OBJECTIVES

The purpose of this laboratory is to teach students hardware and software development of microprocessor based applications. The laboratory complements the lectures by providing hands-on experience with microprocessors, peripheral devices and the required hardware and software development tools.

### EQUIPMENT REQUIRED

1. UF 3701 toolbox including Altera USB Blaster cable, NAD/DAD, and multimeter.
2. In your first lab (lab 0) you will also be given a “bag of goodies,” i.e., parts that you will use during the semester, including the UF 3744 board kit.

### LABORATORY PREPARATION AND ATTENDANCE

Laboratory attendance during scheduled times is mandatory. A **documented** personal or family emergency will be accepted as an excuse for absence for a **second** missed lab if documentation for a **first** missed lab is **also provided**. In such cases, consult your **Dr. Schwartz** (**not** your TA) about a makeup lab **as soon as possible**. See *Course Requirements* for more details. Students should make serious attempts on **all** labs. **Grades less than 50% may be interpreted as not a serious attempt and may be scaled to 0!** Note: **ALL** students **MUST** have everything working **BEFORE** coming to lab.

### LABORATORY ENTRY

A TA will let you in at the start of your lab period. Your TA has the right to kick you out of the lab if you are not prepared, i.e., you have not uploaded the required Canvas submissions and turned in the required hardcopy document or have not built the required circuits. You may also be removed from lab if you are uncooperative or disruptive. You must be able to **demonstrate your understanding** of the design that you have built, the code that you submitted, and the lab topics in general. If you are not properly prepared, you will get a zero for the lab and will be asked to leave. You may **not** make-up this lab later. Therefore, **it is imperative that you come to lab prepared!**

### LABORATORY RULES

0. See the *Lab Rules and Policies* for **complete** information. The first several rules from that handout are repeated below.
1. Lab safety is rule #1. Pay close attention to TA instructions about lab safety, which occurs during your first lab.
2. No food or no drinks inside the Lab.
3. Students work **individually** on each lab project. Do not ask or answer questions from other students during your lab.
4. You can **not** use functions like printf, sprintf, or delay when writing in C, i.e., you must write **all the code** yourself!
5. It is your responsibility to return all equipment and clean your work area before leaving the lab.
6. Students must attend labs during their assigned time.
7. Students must come prepared to the Lab. **No student will be admitted to the lab without the pre-lab work already submitted through Canvas, the required printouts in hand, and the required circuits constructed.** Your files must be submitted through Canvas **BEFORE** the start of your lab.
8. Students must show up to lab no later than **10 minutes** after the scheduled starting time to be eligible to take a lab quiz. If you are late but arrive within the 10 minute window, you may not get any directions for the quiz. If you are later, you **cannot** take the quiz.
9. You may arrive for your lab up to **30 minutes** after the lab start time, but you will be at the bottom of the TA priority list. You will **not** be admitted if you arrive more than **30 minutes** after your lab begins. Note that you may not be able to finish your lab if you arrive late.
10. Most labs will have a quiz. Quizzes might take as long as 1 hour (but could be shorter). Quizzes will be graded on a quaternary (also known as a quinary) scale of 0, 1, 2 or 3. This will translate into values of 0, 15%, 20%, or 30%, respectively to account for up to 30% of the lab grade. Quizzes will cover information from the pre-lab material and previous labs and course work. The items permissible to use during a quiz vary; sometimes you will not be allowed any resources and other times you will be allowed access to your Atmel documents and possibly your own lab software. You will **not** be allowed to access the internet during quizzes.
11. Labs are precisely 2.75 hours (**NOT** 3 hours) long. You will be given **no** extra time.
12. Students **must** be prepared to demo their lab when they enter. Students are **randomly selected** to demonstrate her/his lab work at **any time after the lab quiz is over**. Each student has only a single attempt to demonstrate his/hers work, i.e., the TA will **not** come back to you later. There will be **NO** exceptions.
13. ...

All grades are **non-negotiable one week** after the grade is assigned. Please don't come to me after the final grades have been posted with a hard-luck story.

### LABORATORY ATTENDANCE

Laboratory attendance during scheduled times is mandatory. **Documented** personal or family emergency will be accepted as an excuse for absence for a **second** missed lab if documentation for a **first** missed lab is **also provided**. In such cases, consult your **Dr. Schwartz** (**not** your TA) about a make-up lab **as soon as possible**. See *Course Requirements* for more details. Students should make serious attempts on **all** labs. **Grades less than 50% may be interpreted as not a serious attempt and may be scaled to 0.** Note: **ALL** students **MUST** have everything working **BEFORE** coming to lab.

You will not officially makeup your first missed lab. You should do this missed lab at home (or, if necessary, during a TA office hour) to be sure you understand the required material.

### LABORATORY PREPARATION LIST

1. Always compose, edit, assemble, and print your programs before your scheduled lab.

- *This will save you considerable time and frustration and will improve your performance. In addition, you will have a legible working document.*
2. **Structure your program into functional modules and comment the modules as part of the coding.**
    - *Each subroutine should perform just one function. If a subroutine extends beyond 40 instructions, it is probably doing more than one function and should be split into two or more smaller subroutines.*
  3. **Devise means for testing each subroutine separately so that problem isolation (debugging) is easily accomplished. Assemble the entire program using our assembler.**
    - *These tests should be made as part of your pre-lab preparation.*
    - **Simulate your program with the *simulator* or debug it on your board *before* coming to Lab. Bring to your lab your **working** assembly code and circuit diagram file (if any) on your laptop. Bring a printout of the list file to the lab and circuit diagrams (if any). You will **not** be allowed in the Lab without a commented listing of your code and a circuit diagram (when relevant).**
  4. **Arrive at the lab on time to give yourself adequate time.**

## EEL 3744 LABORATORY SCHEDULE

Lab	Start Date	Tentative Lab Topics (Lab in NEB 281)
0	Mon, 29 Aug	Circuit board construction. Download Atmel Studio and run it.
1	Tues, 6 Sept	Download example program, then simulate, emulate, and “debug” program. Write program; debug, simulate, and emulate program.
2	Wed, 14 Sept	Built-in I/O Port utilization with LED and switch circuits. Also keypad with a single built-in port. Keypad bouncing with DAD oscope. Debugging.
3	Mon, 3 Oct	External Bus Interface (EBI) I/O Port Expansion (for single input and output ports). Bus Timing using LSA.
4	Mon, 17 Oct	External Interrupt. Asynchronous Serial Communication (SCI) with Interrupts.
5	Mon, 24 Oct	A-to-D Conversion (for voltmeter with LCD)
6	Mon, 31 Oct	Output Compare (making music)
7	Mon, 14 Nov	DMA and DAC



**SYLLABUS****EEL 3744 SCHEDULE (Part 1 of 2)**

WEEK/DAY	DATE	LAB #	Class #	Comments
1 M	22-Aug			<b>Classes Begin</b>
1 Tu	23-Aug		1-2	Topic: Syllabus, Web tour, Atmel Studio Installation
1 W	24-Aug			Topic: Intro to uP, XMEGA Architecture, GCPU review
1 Th	25-Aug		3	
1 F	26-Aug			<b>Drop/Add ends Friday at 11:59pm</b>
2 M	29-Aug	0		Topic: Assembly example, GCPU solution to lab 1
2 Tu	30-Aug	0	4-5	Topic: Demo: Assembly, Simulation, Emulation
2 W	31-Aug	0		Topic: Addressing Modes, Instruction Set
2 Th	1-Sep	0	6	
2 F	2-Sep			
3 M	5-Sep		No class	<b>Holiday: Labor Day</b>
3 Tu	6-Sep	1	7-8	Topic: GPIO, Ports, Program Structures
3 W	7-Sep	1		Topic: Data Structures, Stack
3 Th	8-Sep	1	9	
3 F	9-Sep			
4 M	12-Sep	1		
4 Tu	13-Sep		10-11	Topic: Address and Data Bus Timing
4 W	14-Sep	2		Topic: Interfacing, Interfacing Examples, Address Decoding
4 Th	15-Sep	2	12	Topic: Hardware and Software Debugging
4 F	16-Sep			
5 M	19-Sep	2		Topic: Parameter Passing, Keypad
5 Tu	20-Sep	2	13-14	
5 W	21-Sep			Topic: Resets & Interrupts, SCI Interrupts
5 Th	22-Sep		15	Topic: IRQ and XIRQ
5 F	23-Sep			
6 M	26-Sep			Topic: SCI (Asynch Data Comm) ( <i>CISE Career Workshop</i> )
6 Tu	27-Sep		16-17	Topic: Intro to C
6 W	28-Sep			<b>Career Showcase (Technical Day, Sept 28<sup>th</sup>)</b>
6 Th	29-Sep		18	
6 F	30-Sep			
7 M	3-Oct	3		
7 Tu	4-Oct	3	19-20	Topic: D/A and A/D Conversion, A/D Subsystem
7 W	5-Oct	3		Topic: LCD, Lookup Table
7 Th	6-Oct	3	21	
7 F	7-Oct			
8 M	10-Oct			<b>EXAM 1: Mon, 10 October, 5:10pm, in _____</b>
8 Tu	11-Oct		22-23	
8 W	12-Oct			Topic: Basic Timer System
8 Th	13-Oct		24	
8 F	14-Oct		No Class	<b>Holiday: Homecoming</b>

**SYLLABUS****EEL 3744 SCHEDULE (Part 2 of 2)**

WEEK/DAY	DATE	LAB #	Class #	Comments
9 M	17-Oct	4		Topic: Exam 1 Solutions
9 Tu	18-Oct	4	25-26	Topic: Output Compare System and PWM
9 W	19-Oct	4		
9 Th	20-Oct	4	27	
9 F	21-Oct			
10 M	24-Oct	5		Topic: Signal Generation & Output Compare System
10 Tu	25-Oct	5	28-29	Topic: Input Capture System
10 W	26-Oct	5		
10 Th	27-Oct	5	30	
10 F	28-Oct			
11 M	31-Oct	6		Topic: DMA and DAC
11 Tu	1-Nov	6	31-32	
11 W	2-Nov	6		
11 Th	3-Nov	6	33	
11 F	4-Nov			
12 M	7-Nov			Topic: SPI Subsystem
12 Tu	8-Nov		34-35	<b>EXAM 2: Tues, 8 Nov, 5:10pm, in _____</b>
12 W	9-Nov			
12 Th	10-Nov		36	
12 F	11-Nov			<b>Holiday: Veteran's Day</b>
13 M	14-Nov	7		Topic: Multitasking
13 Tu	15-Nov	7	37-38	
13 W	16-Nov	7		
13 Th	17-Nov	7	39	
13 F	18-Nov			
14 M	21-Nov			<b>Drop Deadline: Mon, 21Nov @ 11:59pm</b>
14 Tu	22-Nov		40-41	Topic: Other microprocessors and microcontrollers
14 W	23-Nov		No Classes	<b>Holiday: Thanksgiving Day Break</b>
14 Th	24-Nov		No Classes	<b>Holiday: Thanksgiving Day</b>
14 F	25-Nov		No Classes	<b>Holiday: Thanksgiving Day Break</b>
15 M	28-Nov			Topic: Applications of Microcontrollers to Robotics
15 Tu	29-Nov		42-43	
15 W	30-Nov			
15 Th	1-Dec		44	
15 F	2-Dec			
16 M	5-Dec			
16 Tu	6-Dec		45-46	<b>EXAM 3a, Tues, 6 Dec during class</b>
16 W	7-Dec			<b>EXAM 3b, Wed, 7 Dec at 5:10pm in _____</b>
	15-Dec		Final	<b>NONE (I'm in Hawaii!!) (Scheduled for 5:30-7:30pm)</b>