ECE 2534 – Microcontroller Programming and Interfacing

Spring 2018 - Dr. L. Nazhand-Ali

1. Description

You may own one or two general-purpose PCs, but you probably own 100 microcontrollers as well. They're among the most pervasive digital component around, and they are used for anything from car-brake control to doorbell melody sequencing. In this course, you will learn about this digital component, how to program it in C, and how to interface it with embedded peripherals.

2. Formal Objectives

Having completed this course, the student will be able to

- develop software for microcontroller systems using a high-level programming language;
- demonstrate familiarity with common microcontroller subsystems, such as timer modules;
- demonstrate an ability to use both polling and interrupt-driven approaches for interfacing a microcontroller with peripheral devices;
- develop and analyze software to interface a microcontroller with common peripheral devices, such as switches, visual displays, digital-to-analog converters, analog-to-digital converters, and flash memory to produce a system to accomplish a specified task;
- design interfaces to external devices connected to the microcontroller using a standard bus; and
- describe the roles of microcontrollers in contemporary systems, including common consumer products.

3. Prerequisites

- ECE 2504 (for concepts related to digital logic, data representation, computer arithmetic, basic computer organization and operation).
- Practical knowledge of the C/C++ programming language, as taught in 1574. This course does not teach how to program C; it teaches how to program a microcontroller using C.

4. Text and References

There are no required textbooks. Data sheets, user manuals, and other materials will be available for download at no cost.

5. Equipment and Design Software

- The ECE department will lend a lab kit for this course to each student. The kit will contain a microcontroller board, several small peripheral modules, and several cables. We will provide instructions on when to pick up your kit from the CEL. You are required to return these materials to the CEL at the end of the semester when you complete the last lab assignment.

- You will need to develop software for the board using the Texas Instruments Code Composer Studio. This software package is available to everyone at no cost. Installation instructions will be posted at Scholar as part of the first lab assignment.

- All students are expected to own a laptop that meets College of Engineering requirements.

6. Grading

Semester grades will be based on the following weights.

- Quizzes 5%
- Homework (7+) 15%
- Labs (4) 30%
- Midterm exams (2) 30%
- Final exam 20%

7. Quizzes

There will be a short quiz almost every time our class meets. I will provide a password during class time to access the quiz. Sharing the password with students not present at class will constitute violation of Honor Code policy. If you are not able to attend the class for any reason, you can email me directly.

8. Homework

There will be several (seven or more) homework assignments. Some of these may require you to develop software. ***Late homework will not be accepted.*** Your lowest two grades will be dropped.

9. Labs

There will be 4 lab assignments. Lab 1 constitutes 3% of your total grade. Lab 2, Lab 3 and Lab 4 are weighted based on your grade: 7% your lowest lab grade, 9% your middle lab grade and 11% your highest lab grade. Labs can be submitted within 48 hour from due date with 25% reduction in grade.

You are responsible to make sure you have submitted the correct files by the due date (or within grace period). Problems with your computer, your board, Canvas website or any other technical difficulties does not warrant an extension (see the section on “When the trouble strikes on how to get help in such situations). Your grade will be based on the file(s) you submit. **Even if the timestamp on your file in your computer shows it has not been modified after due date, it cannot be used for grading.**

10. Exams

Students are expected to take all examinations during the announced time periods. The midterm exams will be held in classroom during regular class time. There will be no make-up exams. **A missed exam receives a grade of 0.**

11. Appeals

If you feel that an error has been made in grading an assignment or exam, please notify the person who did the grading within one week after the material is returned. No appeal is accepted after one week period either for exams or assignments.

12. Honor Code Policy

The Undergraduate Honor Code pledge that each member of the university community agrees to abide by states:
“As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do.”

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit:www.honorsystem.vt.edu.

Exams are to be completed individually. Homework problems may be discussed with other students, but the final solution is to be your work. Source code may not be shared: obtaining source code from any source other than your instructor, a GTA, the course notes, or the PIC32 peripheral libraries is an Honor Code violation. Automated plagiarism detection will be employed.

Virginia Tech has recently increased the penalty for the first offenders. Do not take any chances. A grade zero for a lab assignment will not result in failing your course. Nevertheless, violating honor policy even for a homework does result in course failure.

13. Special Needs

Students who need special accommodations (due to a disability or a religious holiday, for example) should notify the instructor during the first 2 weeks of the semester. Students need to work through the office of Services for Students with Disabilities (SSD).

14. Illness and Other Personal Emergencies

In case of illness, professionals at Schiffert Health Center can send documentation of your illness to the office of the Dean of Students. **A note showing you have been seen at Schiffert is not a sufficient proof of illness.** If you experience a personal or family emergency that affects your studies, please contact the Dean of Students or your academic advisor and ask them to contact me.

15. Getting help

The best way to get help with the course is attending office hours at the CEL. CEL is open every day and has extended hours which should accommodate any schedule. The next best way is to come to my office hours. I will have relatively regular office hours scheduled throughout the semester. They will be posted on Canvas calendar. Please check the calendar before showing up at my office, as I might need to change them for various reasons especially in the first few weeks of the semester. If none of my office hours work for you in a particular week, please email me, and I will try to find a time to meet with you **within one week from your request**.

We will use piazza.com for class communications. If you do not have an account, it is very easy to create one. You can send public or private messages to instructors and GTAs on piazza. **We will reply to your questions within 48 hours from receipt**. That means if you send questions two days before a deadline, you will not get answers early enough to solve your issues.

16. When Trouble Strikes

Due dates will not be extended because of problems with equipment, communication networks, power outages, or computer viruses. **Because of this, it is important to plan carefully and keep regular back-up files.**

If you have trouble with your equipment, you should meet with a 2534 GTA in the CEL. The GTA can exchange parts that do not function correctly. If your laptop crashes, then you should seek help from www.4help.vt.edu. If they cannot help you fix the problem, then you should ask swat.eng.vt.edu for assistance. If that avenue fails, then you may be able to borrow a laptop from www.helpdesk.ece.vt.edu. With any of these solutions, you will need your back-up files in order to continue your work.

17. Strategies for Success

- *Take advantage of office hours and CEL sessions.* The instructor and the GTAs are available several hours every week to help with the course material.
- *Keep up.* Each assignment tends to build on previous assignments. It is not easy to catch up after falling behind.
- *Plan ahead and start early.* Some of the assignments will require large commitments of time. Careful management of your time will allow you to avoid last-minute rushes, and will provide the opportunity to seek help when it is needed.
  As mentioned earlier, questions on piazza are guaranteed an answer only within 48 hours of posting. The CEL is also very crowded close to deadlines. Be an early bird, beat the crowds.
- *Make back-up copies of your files.* Put these copies on removable media or in “the cloud”, so that you can continue working on borrowed equipment if your laptop or Digilent board is damaged.