EC450 Course Overview

Welcome to EC450!
EC450 meets 2-4 MW and is assigned to classroom SAR 300. We will also sometimes meet in the MicroLab, PHO 115.

- There is an official Blackboard 8 site on http://blackboard.bu.edu
- There is an unofficial backup site for notes at http://tina.bu.edu/ec450s11

Course Description
This course focuses on the interface between the digital world and the physical world. Hardware and software design methodology for embedded microcomputers. Open laboratory and projects and lots of hands-on work. Architecture, hardware, I/O, interrupts, memory organization and decoding. Illustrates concepts with the TI MSP430 family microcontrollers. Peripheral devices including general digital I/O, timers, analog to digital converter, and synchronous serial interfaces SPI and I2C.
The course stresses the dependency of hardware and software design on project identification, rationale, and goals.

Course work
Work for the course includes regular homework, tests and quizzes, and a final project. There is no final exam.

Homework
Homework involves written work, programming, and lab work building systems. In all cases, you should upload your homework (written responses, schematics and diagrams, program source code/listing) to the digital drop box which is present on the Blackboard site by the end of the day that it is due. Initial homework will be individual. Later homework will be in teams of two.

Tests and Quizzes
There will be two tests and one or two quizzes (tests take the whole class period, quizzes are about ¾ of an hour). The purpose of these is both to check your understanding and to be benchmarks for your progress.

Final Projects
Teams will design and create final projects that are to be completed and presented before the end of the term.

Participation Notes
- The Blackboard website will be used for communication about the course and will contain announcements and pointers to resources as well as the drop-box for written materials. Please refer to it often!
- This is a HANDS-ON course! Regular attendance is a must and turns out to be one of the best predictors of your final success and grade.
- There will be regularly scheduled meetings of each student/team with the instructor to discuss/demonstrate the week's homework.
- For each lecture, a student will be designated as a 'rapporteur'. All students will have turns at this. When it is your turn, you will:
  1. Make and post a list of topics touched on during the class section and whatever you thought were the most interesting points and references, so that we can keep a good set of online notes for the class sessions.
  2. Lead a brief discussion of the class you summarized at the start of the next class.
Grading scheme
The course work components are weighed as follows in determining your final score.

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<td>Attendance; responsible behavior and teamwork; evidence of attention, spot checks, live questions, and oral interviews; Rapporteurs' reports</td>
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Literature and Textbooks
The required literature consists of TI manuals - available with your microprocessor kit and also freely downloadable - and a number of lecture 'handouts' (which will be available on the Blackboard website). There is no mandatory textbook to buy. There are reference and introductory materials available in the lab. See the resource pages on the course website for many useful links!

Course Topics
This course pursues several threads in parallel in order to acquaint students theoretically and practically with microcontroller based systems.

Background
1.
   - Introduction to microcontrollers: history, objectives, tradeoffs, pricing; the design loop.
     - Microcontrollers vs microprocessors.
   - General approaches to microcontroller interfacing. Why you need to remember ECT!

Microcontroller Programming
1.
   - Decimal, binary, and hexadecimal representations.
     - Assembler source and listing. Examples of assembly code.
   - Using an Integrated Development Environment -- project design and development and debugging
   - The stack. Procedures.
   - Interrupts: how they work, how they are used, how they are programmed. Task dispatching by interrupt. Timer interrupts.

Peripherals and Interfacing
1.
   - Input ports and output ports.
   - Turning LEDs on and off.
   - Frequency, period, wavelength; Timers and the clock. Periodic signals.
   - Sensors and actuators in circuit; how they typically appear as components of a voltage divider. Voltage and current measurements. Switches, LEDs, solenoids.
   - Interrupt driven input; debouncing.
   - Serial Interfaces (SPI, I2C, UART)

Hardware/Projects
1.
   - Prepping and powering your evaluation board
   - Scavanging great components from 'junk' :-)
   - Standalone operation from FLASH and EEPROM memories.
   - Design and construction of projects.
   - Power conservation for battery operation.
   - Design and Testing of systems
Some Lab Notes (more details to follow)

Our battle-horse will be the TI MSP430 ultra-low power microcontroller. The main hands-on work will be done using the TI MSP430 LaunchPad Development Tool. We have several other MSP430 family processors in the lab. Each student will be required to purchase a Launchpad tool. These come with hardware and software that can be installed on your own PC if you desire. Finally, you'll need your own portable volt-ohm-meter; any cheap model, possibly with Amp scales as well as Volt and Ohm, will do.

The MicroLab in PHO 115 is available for your use. There are cabinets of parts and connectors and other things you may find useful.

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