EGR 326
Embedded System Design
Fall 2009

Description

This course will introduce you to the design of embedded electronic systems. The course will be nearly evenly split between the presentation of theoretical ideas and their implementation. Building upon the introductory material in EGR 226 and EGR 214, this course examines the principles and practices necessary to understand how to design and build actual embedded system products.

The task of an embedded system designer is challenging and interesting since a wide variety of engineering constraints must be managed simultaneously. These constraints may include cost, size, power consumption, heat dissipation, battery life, electro-magnetic interference and susceptibility, electro-static discharge immunity, usability, and functionality. In order to be successful, the embedded system designer must possess creativity, competence, perseverance, communication skills, a broad education, and at least a little bit of talent. Hopefully, this course will allow you to cultivate the above.

Prerequisites/Corequisites

Prerequisites: EGR 214, EGR 226

Instructor

Prof. Andrew Sterian
KEN227
<steriana@gmail.com>
331-6756

Meeting Times

Lectures:	Monday, Wednesday, Friday 11:00-11:50 PM, KEN222
Labs:	Monday, Wednesday 2:00-4:45 PM, KEN236

Office Hours

Monday, Wednesday, Friday:	12:15 - 1:00 KEN227
Thursday:	12:00 - 2:00 KEN227

Office hours may be interrupted/supplanted by department meetings or other unplanned "distractions". In other words, don't assume that you can find me in my office during office hours. Please become very proficient and comfortable at communicating with me via e-mail. I'd be glad to schedule an appointment with you in person, either during office hours or at other available times.

Required Texts/Supporting Materials

(1) Sterian, A. *EGR 326 Lecture Notes*, Revision 1.7, 2009 (available in the bookstore)
(2) MW2 or MW3 circuit board ($35/$45, purchased from Prof. Parikh with cash or check payable to "School of Engineering"). Students who already purchased an MW2 board for use in EGR226 do not need to purchase another one.

There are several additional resources that you may find useful for this course. These will be listed on the class web site: <http://claymore.engineer.gvsu.edu/~steriana/326>. You should become accustomed to checking this web page regularly for announcements and links to useful items.

Grading

There will be two mid-term exams held during class/laboratory periods. There will be a "final quiz."

You will be submitting approximately 6 homework assignments comprising both homework-type problems as well as lab writeups. These are due ***at the beginning of class***. After assignments are collected, solutions will be handed out. As a result, ***no late submissions will be accepted***.

You will also be responsible for a project that is to be completed by the end of the semester and will form a significant part of your grade. In this project, you will carry a concept from initial specifications all the way through to a finished product that you can (and will) demonstrate to others. This component of the course is described in more detail in a separate handout.

The dates and approximate weightings of the exams, quizzes, and homework are shown below.

Exam #1	October 5	20%
Exam #2	November 9	20%
Exam #3	December 16	10%
Project	December 10	35%
Assignments	Occasional	15%

The following grading scale will be used throughout the course for all grading components (exams, homework, project, and final grade).

A	90.5-100%
A-	86-90.5%
B+	81.5-86%
B	77-81.5%
B-	72.5-77%
C+	68-72.5%
C	63.5-68%
C-	59-63.5%
D+	54.5-59%
D	50-54.5%
F	0-50%

Note that I will only assign letter grades at one time in the course: for your final mark. At all other times, a percentage score will be used. You can use the above mapping between letter grades and percentage scores to give you a rough estimate for how you are faring in the course.

Because of the above policy:

- Scores are not quantized to letter grades until the very end, thus...
- A few points here and there won't make any difference to your final grade.

I assign grades based upon an overall assessment of your work, and your final grade may be adjusted ***up or down*** based upon this assessment. Consider each one of the above grading instruments as pieces of evidence. Taken together, they paint an overall picture of your knowledge and understanding. Other pieces of evidence include your attendance and participation in class and laboratory, the effort you put into completing your assignments, and any efforts you make to complete extra-credit problems. Extremely important are your participation and engagement in the course project, and poor performance in these domains will ***greatly*** reduce your final grade.

Course Policies

This course will make extensive use of tools, both in software and hardware. Some class and/or lab time will be spent on introducing you to these tools but you are also expected to be resourceful and self-sufficient. Embedded system design is a tool-intensive sub-field of electrical and computer engineering. Take the time to learn and know your tools well.

You are allowed (and encouraged) to work on assignments in groups, but all submissions must be **individual work**: your own work and prepared in isolation from all other students. Students who "clone" others' assignments are readily identifiable because they do well on the assignments and poorly on the exams. The picture painted by this kind of evidence is not good. The School of Engineering document "Standards for Submission of Student Work" is directly applicable to this course.

Take note, especially, that you will be working together in the lab to acquire data, set up circuits, etc. but the reporting requirements for the assignment must be written by yourself. That is, you are expected to analyze and interpret your lab experiences separately from your partner (again, performing under the standard of **individual work**).

Everything you submit will be graded according to the following criteria:

- Clear and cohesive solutions
- Adherence to specific instructions
- Legible writing
- Correct spelling
- Correct grammar
- The right answer

Disability Support Services

If there is any student in this class who has special needs because of learning, physical or other disability, please contact me and Disability Support Services (DSS) at 616.331.2490. Furthermore, if you have a disability and think you will need assistance evacuating this classroom and/or building in an emergency situation, please make me aware so I can develop a plan to assist you.

Laboratory Safety and Stewardship

You are expected to adhere to the Laboratory Safety for ECE Labs document provided separately. You are also expected to take good care of the laboratory including:

- Returning all supplies and components to their proper locations
- Maintaining a neat workstation free of food, trash, and debris
- Not eating or drinking near the laboratory equipment
- Handling all equipment and supplies with care and with appropriate respect for property
- Promptly reporting all broken equipment to the Laboratory Supervisor, Ron Grew <grewr@gvsu.edu>
- Not removing any equipment or supplies from the laboratory (this will be considered a SERIOUS ACT OF THEFT)
- Cleaning up after yourself, and cleaning up after others who are inconsiderate because they do not (yes, we know it isn't your mess but maintaining a clean, orderly lab is *everyone's responsibility*)

Course Topics

(1) Power Supplies
   - Regulation concepts and circuits
   - Linear regulators
   - Switching regulators
   - Voltage references, voltage converters
   - AC-to-DC conversion
   - Off-line switching regulators

(2) Analog Models of Digital Devices
   - Input and Output Models
   - The Digital Contract
   - Open collector drivers, tri-state drivers, Schmitt trigger inputs

(3) Analog Building Blocks
   - Comparators
   - Op-amps
   - Optoisolators
   - Analog switches, digital potentiometers
   - A/D, D/A converters

(4) Digital Building Blocks
   - Combinational building blocks
     - Encoders, decoders, multiplexers
     - Memories

    - ALU's
    - Buffers and transceivers
  - Sequential building blocks
    - Flip-flops, latches, registers
    - Shift registers
    - Counters
  - Finite state machine review
(5) Timing Analysis
  - Timing parameters
  - Timing margin calculations
(6) Microcontrollers
  - Architecture
  - Programming paradigms
  - Timing
  - Interrupts
(7) Additional topics (as time allows)
  - Signal integrity
  - Programmable logic devices
  - Heat in electronic systems
  - Circuit protection