UNC - Charlotte, Department of Electrical and Computer Eng.

Syllabus for ECGR 3090/5090/6090: Introduction to Embedded Systems - Fall 2003

Instructor: James M. Conrad, Associate Professor of ECE (new faculty in Fall 2003)

Register for: ECE**3090**, Section **003** (15234 - undergraduates) or ECE**5090**, Section **003** (15235 - graduate students) or ECE**6090**, Section **C01**

Lecture: MW 12:00 - 1:20 p.m., Smith 260.

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Graders: TBD

Prerequisite

Grade of C or better in ITCS 3182.

Textbook and Class Materials

Required: Students will be required to purchase a microcontroller evaluation board with software tools to use for the laboratory; they will keep this board after the class ends for use in other classes (e.g. senior design). The cost per student is expected to be about $50.

Required: Each lab pair will be required to purchase a cable set for use in labs ($10). This consists of:

- 3 or 6 foot DB9 female to DB9 male cable
- DB9 male to DB9 male gender changer
- DB9 male to DB9 female null modem adapter

Required: Note that you will be required to read articles off of the class website.

Optional: Class notes are available in the campus bookstore (in a course pack) or online. Since tests are open book, open notes, it is recommended you obtain a copy.

Catalog Description

Introduction to designing microcontroller-based embedded computer systems using assembly and C programs. Examination of Real-time Operating Systems and their impact on performance.

Purpose of Course

The goal of this course is to solidify and build upon a student's knowledge of computer organization by presenting hands-on experience with microcontrollers. Students will also examine a few sensors that are used in commercial and medical products and learn how to interface them in a microcontroller system. Students will:

- Recognize and identify the constraints facing embedded system designers, and determine how to assess them.

- Program a modern microcontroller in assembly language and operate its peripheral devices.
- Interpret how the assembly code generated by a compiler relates to the original C code.
- Practice thread-based program design with a real-time operating system.
- Develop programs controlling embedded systems using quick and efficient methods.
- Predict, measure and manipulate a program's execution time.

Labs

The laboratory projects are an integral part of the course and are intended to provide experience in the application of the design techniques discussed in lecture. These projects will utilize the embedded systems board required for the class. There will be six to ten lab exercises assigned.

Lab exercises can be done in the Embedded Systems Teaching Lab or on your own home PC.

Because almost all of us learn by doing, the laboratory will probably be the most effective method for learning the material, and will help you on homeworks and exams. Also, ask yourself questions while preparing for the lab and during the lab. Do not just passively and monotonously follow the lab write-up-- ask some of your own questions and then find out the answers with your computer. To learn, you need to do it and you need to creatively think about what you are doing! Lab grades will be based on lab write-ups and demonstrated functionality of problem requirements. One lab report per lab pair is due at the specified time.

The lab report grade will be determined according to

- **Technical Content:** Technical Content refers to the answers you provide to questions asked during the experiment. Make sure you understand the material before leaving the laboratory because these questions will be graded for correctness. Students often lose points for not answering all of the questions, neglecting to answer each part of a multi-part question, or leaving out required figures or tables.

- **Presentation:** Presentation refers to the overall "look and feel" of the lab report, which includes such items as format and content. You shouldn't be embarrassed by your lab report

Homework

Homework is another example of learning by doing. Although not as exciting as a lab, homework is essential to learning the concepts in this course. Homework will be in the form of reading assignments and problem sets, with a due date 1-2 lectures after it is assigned. **No late homework will be accepted.** Homework must be turned in at **the beginning of lecture (before lecture begins)**. Homework must be done individually (you will learn the most from this). Any evidence of group participation will be interpreted as academic dishonesty. Here are some guidelines for homework assignments:

- You will typically get better grades on homework if they are typed
- Do not repeat the question on the homework sheet.
- Do not put a printout of the assignment sheet anywhere in your turned-in homework.
- Staple all pages together
- Do not fold the assignment when you turn it in.
- Hand in a hard copy of your homework

- Check the class web site for a MS Word file that is a template for homework. Replace the information in the header with your particular information.

If you have a dispute with how an assignment is graded, you should follow this procedure:
1. Get the solution to the assignment off the class web site and examine it. You may have just worked the problem incorrectly.
2. If you really believe that your answer is correct (matches the answer given in the solution), contact the TA who graded your assignment and discuss it with them. He/She will listen to your concern, and act on it, at his/her discretion. In any case, they will sign the homework verifying that they saw it again.
3. If you are still not satisfied with the resolution, you may bring the homework to me for review. I will not review homework that has not been seen and signed by the TA.

We record all "disputed" points in a separate column. We contend that "disputed" points never add up to a change in your final grade, and we will examine this when final grades are assigned. Note that TA addition errors should follow the above procedure, but will not be figured in the "disputed" column. There will be 10-12 assignments. Only the highest 10 scores will be used in your course grade.

Quizzes

There will be several "pop" quizzes given throughout the semester. These will be to reward students who consistently show up to class and are prepared. The points will be used more than for "attendance points."

Exams

There will be one mid-semester exam and one final. Exams will be open-book and open notes. Exams will include material from the lecture, the readings, homework, and laboratories.

Exam dates (preliminary):

- Mid-semester exam: Wednesday, October 15, class time in regular classroom
- Final exam: Monday, December 15, 12:00 - 3:00 p.m. in regular classroom

Missed exams: Attendance at all exams is mandatory. Only legal or debilitating medical excuses will be accepted (read: prison time, major blood loss, etc.), provided that they are accompanied by the appropriate official documentation. Makeup exams are more difficult than the exams they replace; few have passed. Failure to satisfy these criteria will result in a zero grade for the exam.

Missing Class/Assignments

Throughout the semester, a student may miss classes/assignments/quizzes/exams due to many reasons. Most of the reasons ***will not*** be accepted as an "excused" absence. That is why one or two of the homeworks are dropped when determining your final grade. Plus, you can always email your homework. For example:

- ECGR or other class exam review sessions: All ECGR3090/5090/6090 class and exam times take precedence over any review sessions.

- University sponsored activity: All ECGR3090/5090/6090 class and exam times take precedence over any University-sponsored activity.
- Business trips: If you miss an ECGR3090/5090/6090 assignment/quiz because you were on a business trip, you miss out on the assignment/quiz points.
- Illness: If you miss an ECGR3090/5090/6090 assignment/quiz because were ill, you miss out on the assignment/quiz points.

Course Lectures.

We will use transparencies to teach this class. You can download them and print them from the web. See the web for the course lecture outline.

Project for ECGR5090/6090

It is expected that students registered for 5090 and 6090 will do an additional project, to scope of which is agreed-upon by the instructor. Some areas include:

- Stiquito Controller board design, placement, and routing using TI chip and Mentor Graphics tools – early semester project.
- Stiquito Controller board design, placement, and routing using Atmel chip and Mentor Graphics tools – early to late semester project.
- Stiquito Controller board design, placement, and routing using Renesas chip and Mentor Graphics tools – early to late semester project.
- Converting class note chapter to an Atmel chip - late semester project.
- Assist in the development of an Embedded Systems text book (i.e. written materials search and summation of the papers/books of each particular topic) early to late semester project.

Grading Percentages and Grade distribution

	ECGR3090	**ECGR5090**	**ECGR6090**
Homework assignments	20% (200 points)	xx% (200 points)	xx% (200 points)
Lab assignments	25% (250 points)	xx% (250 points)	xx% (250 points)
Quizzes	5% (50 points)	xx% (50 points)	xx% (50 points)
Midterm Exam	20% (200 points)	xx% (200 points)	xx% (200 points)
Final Exam	30% (300 points)	xx% (300 points)	xx% (300 points)
Project		xx% (150 points)	xx% (200 points)
Total	100% (1000 points)	100% (1150 points)	100% (1200 points)

Academic Dishonesty

All the provisions of the University code of academic integrity apply to this course. In addition, it is my understanding and expectation that your signature on any test or assignment means that you neither gave nor received unauthorized aid.

Please read the discourse on cheating and ECGR 3090/5090/6090 on the web page. For homework and laboratory projects, while collaboration is allowed, direct copying is not and students must turn in individual submissions. Realize that mastery of the material in the homework and lab assignments will be essential for a good performance on the exams!