BACKGROUND

Mechatronics may be defined as the synergistic integration of precision mechanical engineering, electronics, and computer control in the design of industrial products and manufacturing processes.

COURSE OBJECTIVES

The objective of this course is to provide mechanical engineers with necessary fundamental knowledge and hands on training in embedded microcontrollers, sensors, actuators, and real-time software design in order to design and build intelligent mechatronics systems. The students will learn individual topics through lectures, reading assignments, and laboratory assignments and demonstrate competence in system design and integration through a final project.

SYLLABUS

Programming in C, analog circuits and electronic components, logic gates, circuit design and analysis, introduction to microprocessor architecture, programming the microcontroller using cross-compilers, interrupts, digital signal generation and pulse width measurement, sensors and actuators, signal conditioning circuits and interfacing, A/D and D/A conversion, real-time programming concepts, direct digital control. THIS COURSE IS HEAVILY HANDS-ON PROJECT ORIENTED.

Laboratory work and small projects will be assigned to help solidify learning throughout the course such as programming, working with microprocessors, and interfacing sensors and actuators. In addition, teams will work on a final design project that is of reasonable complexity. The teams will design, build, and demonstrate their solution to the assigned problem. Off campus students will work on their project with the kit purchased.

RECOMMENDED TEXTS


PRE-REQUISITES
Senior /Graduate Standing, Structured Programming Experience or Permission of Instructor.

OFFICE HOURS
My office is in 1217 Broughton Hall. Office hours are MWF 8:30-9:30. The best way is to contact me by email and setup an appointment. rammk@ncsu.edu. When you send an email to me, ALWAYS USE MAE534-2007 (no spaces) AS THE SUBJECT OF THE MAIL since I search my mail based on the subject and respond to it. Use the bulletin board in Wolfware for the course to post questions and I can answer them for everyone to see. You can also post answers to questions.

EVALUATION
Assignments/Projects 30%
Mid-term Test / Project 20% (Thursday, 20th March. 2007)
Final Project demonstration and Report 50% (May 1st, 2007 1:00-4:00 pm)

The final project report and project demonstration will be used in lieu of the final exam.

There will be a peer evaluation form to evaluate each team member's contribution anonymously. This information will be used to discriminate among team member grades. In other words, better do your fair share and get along with others!!

LABORATORY
Plan on spending a lot of time in the laboratory outside of class schedule (off campus students will do projects in their home/workplace). On Campus, we will work in the Mechatronics Design and Manufacturing Laboratory located in 2118 Broughton Hall. Please do not touch anything that is part research equipment in this laboratory.

SAFETY
Please think about safety at all times. Simple rules to follow include, keeping your work area free of clutter, checking that the devices are not plugged in BEFORE touching any electrical/electronic equipment, not inhaling soldering fumes, and staying away from hot soldering tip, cutting wires while moving the knife away from you, working on a stable clear surface, using safety goggles when doing light machining and drilling and following standard machine use practices. If you do not know how to operate a piece of equipment, please ask before you try to use it. NEVER work alone in the laboratory.
WOLFWARE

I will be posting all the course contents and lecture materials in the Wolfware site for this course. Please visit http://wolfware.ncsu.edu and log for course lockers and identify MAE534 course locker.

TENTATIVE SCHEDULE OF TOPICS

<table>
<thead>
<tr>
<th>Topics</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction and C-Language</td>
<td>(2 Weeks)</td>
</tr>
<tr>
<td>Electronics Fundamentals</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Analog Electronics</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Digital Electronics</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Microprocessors</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>HCS12 Microcontroller Architecture</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Autonomous Mobile Systems Control Strategies</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Real-time Programming Concepts</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Sensors and Actuators</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>A/D Conversions and Interfacing</td>
<td>(1 Week)</td>
</tr>
<tr>
<td>Final Project Demo and Report</td>
<td>(All Laboratory Times)</td>
</tr>
</tbody>
</table>

KIT FOR OFF-CAMPUS STUDENTS

The kit for off-campus students will be available after 15 days of start of class. Since the actual cost of the contents exceeds $300, this is clearly not a business proposition as my laboratory funds are subsidizing the kit. I plan to send out the kit to students in class, immediately after the course add deadline. If you wish to receive the kit from me and keep it, it is suggested that you make a donation to the Mechatronics Design Laboratory by sending a check payable to "NC State University Engineering Foundation, Inc." towards replenishing supplies in the laboratory for future students. You should write a short letter to that effect that it is a donation for this purpose along with your check. The suggested donation is $300. Please send the letter and check to Dr. M. K. Ramasubramanian, Associate Professor, Mechanical and Aerospace Engineering, 2229A Broughton Hall, NC State University, Raleigh, NC 27695-7910. UPON RECEIPT OF THE CHECK AND THE LETTER, YOUR KIT WILL BE SHIPPED.

If you plan to acquire the kit materials yourself, I can provide the parts list. In that case, I don't need any donation from you. In some instances, students have sent in less than $300, but returned the parts after use. This is a less preferred option, although I am open to it on a case by case basis. The items that you may need in addition are small tools, solder wick or puller if you want to make you life easier, scrap wires, miscellaneous resistors that you may need (you can buy from Radio-Shack). We will use EmbeddedGNU freeware for our class. No software purchase is required.