DEFINITION

Mechatronics is the synergistic combination of mechanical engineering (“mecha” for mechanisms), electronic engineering (“tronics” for electronics), and software engineering. The purpose of this interdisciplinary engineering field is the study of automata from an engineering perspective and serves the purposes of controlling advanced hybrid-systems such as production systems, synergy-drives, planetaryrovers, automotive subsystems such as anti-block system, spin-assist and every day equipment such as autofocus cameras, video, hard disks, cd-players, washing machines, lego-matics etc.

Mechatronics is centred on mechanics, electronics and computing which, combined, make possible the generation of simpler, more economical, reliable and versatile systems.

The word “mechatronics” was first coined by Mr. Tetsuro Moria, a senior engineer of a Japanese company, Yaskawa, in 1969. Mechatronics may alternatively be referred to as “electromechanical systems.”

INSTRUCTOR:

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E2-316 (Autonomous Systems Lab), 9-2140
LAB SECTIONS

This year, we split across two labs, BE-115 and BE-113. Later you will also be working doing fabrication in BE-138. The lab will be open to you 24/7, and you will be spending lots of hours in there; this is primarily where and when you learn the material.

Lab sections are times when the tutors/TA’s and the instructor show up to help out, do lab check-offs, answer questions, and otherwise help out. These are the only times someone will be there guaranteed to help. The scheduled times are:

- Mondays 3-5 PM
- Tuesdays 12-2 PM
- Wednesdays 3-5 PM
- Thursdays 6-8 PM
- Fridays 3-5 PM
- Sundays 3-5 PM (Oh, yes, we’ll be there)

TEXTBOOKS (ALSO IN THE LIBRARY ON RESERVE):


Optional Textbooks (good references):


READINGS

There is quite a bit of material to cover in this class, and you are expected to have read the assigned reading before coming to class. You will get out of this class what you put into it. Simply put, if you do not do the reading, you will not effectively learn the material. We have gone to quite a bit of trouble in order to find appropriate reading for you, so take the time to read them.

This year, we are using a recently published textbook, *Introduction to Mechatronic Design* with most of the readings and example material drawn from this book. In the syllabus, this book is referred to as CKO. Most of the other reading is from Horowitz and Hill, which while dry, remains the best reference for the material hands down.

GRADING

This course is based on a combination of the lab and class. They go together and are indivisible (they are divided only because that is how things are done here, ideally it would be just one class). If you cannot complete the lab, you cannot complete the course. You will receive the same grade on the
course and the lab, and cannot pass one without passing the other. This is essentially a hands-on project class, and the grading reflects this status.

<table>
<thead>
<tr>
<th>COURSE:</th>
<th>67%</th>
<th>Labs and Projects</th>
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<tr>
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<td>33%</td>
<td>Quizzes, and Exams</td>
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<tr>
<td>QUIZZES, EXAMS</td>
<td>20%</td>
<td>Midterm, 72 Hour Take Home</td>
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<td></td>
<td>12%</td>
<td>Quizzes (every week on reading)</td>
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<td>1%</td>
<td>Participation</td>
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<td>LABS AND PROJECT</td>
<td>8%</td>
<td>Lab 0</td>
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<td>Lab 3</td>
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<td>Project</td>
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Note: there is a sure fire quick and easy way to fail this class—-that is to end the quarter without cleaning up your lab area and returning the microcontroller and daughter boards back to the TA’s or the instructor.

**NOTE ON ATTENDANCE:**

There will be a quiz at the beginning of class covering the required reading material at least once a week. No make-up quizzes will be given, nor will there be any opportunity to take the quiz later in that class. If you must miss a quiz, contact the instructor or TAs before the class to make arrangements. The only accepted excuse after a quiz is from the ER. The quizzes are here to get you to do the reading, and the quiz questions come directly from the sources. Do the reading and you will be fine.

**WWW SITE, VIDEOS, AND WEBFORUM**

**Website:** http://www.soe.ucsc.edu/classes/cmpe118/Fall14

Check this site often as this is where the homework assignments, lecture notes, labs, homework and test solutions, and lecture videos are posted. You are expected to read the material on the website.

**Videos:** As an experiment in teaching technology, the instructor will be capturing both the audio and screen from the course in real-time. This will later be posted to the website. While every attempt will be made to capture the classes, as this is a new technology, there are no guarantees. Also, while watching the video should be a great way to review course material, if you are not in class you cannot ask questions and/or clarifications. Further, if too few students show up for lectures, the instructor may restrict access to class videos.

**Piazza:** https://piazza.com/ucsc/fall2014/cmpe118l/home

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, and the Instructor. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com. Do NOT post code or problem solutions unless cleared by the Instructor or TAs (use a private message for that).
COURSE WORK: CMPE 118

Attendance is highly recommended for the lectures as the material builds up quickly. Lecture material will be made available on the website, usually before covered in class. Annotated lecture notes and videos of the lecture will be posted after class in a timely fashion (see note on video above).

There will be weekly quizzes at the beginning of class that are both required and graded. Though they are worth only 13% of your overall grade, they are essential to mastering the material. There will be one take-home midterm exam based on design problems covered in the lecture and on the quizzes. The midterm and quiz material will be based on reading and lecture material.

LAB WORK: CMPE 118 L

This class should be a lot of fun. I would add also a lot of work (think: drinking from the firehose). There is a lot to cover, and only 10 weeks to get you familiar with it and using it in an unstructured project. Prepare to spend at least 20 hours a week on this class, less at first, much more towards the end. We will make every attempt to help you, and to ensure that you succeed, but you have to put in the work yourselves.

You must be enrolled in CMPE 118L to remain in this class. You must pass CMPE 118 to pass CMPE 118L. You will receive the same grade for both the lab and the class, and thus cannot pass one without passing the other. There is a lab fee of $165 per student, which will cover the lab kits and the use of the microcontrollers and daughter-boards (which some of you will manage to damage by the end of the quarter). The lab will be open 24/7; times when the TA’s and the Professor are in Lab will be announced later in the quarter, but expect to spend all night there several times during the quarter.

We will be working with a 32 bit microcontroller, the Microchip PIC32MX320F128H, in the form of the Digilent ChipKit Uno32, and have a number of subsystem modules and daughter boards that will help you through the course. This is a fairly typical microcontroller, inexpensive and powerful enough for the tasks that we will cover. You can buy the same board we are using from Digilent for under $30, and if you wish you may purchase such a board to allow you to work at home. Additionally, you will be working in teams of three for the project, and should think early about who you might want to work with. Since most of you will not know each other, try not to repeat lab partners, so you will have an idea of who you want to work with.

This class is based largely on a team project; as such it has a strong collaborative element. This collaboration is understood, and encouraged. However, this is NOT license to copy others’ work. Credit for collaboration should be explicitly noted; failure to give credit on collaboration is considered a form of cheating and will be dealt with accordingly.

NOTE ON TEAMWORK:

As mentioned above, use the time while doing the labs to get to know your colleagues (there will be mugshots to figure out who everyone is) and try to figure out who you will want to work with on the final project. Your colleagues are a resource; ask them for help when you are lost, and offer help when they need it.

There will be a strong desire towards “divide and conquer” on the labs, where you will split up the lab with your partner and each do parts independently and share your results. This is a very bad idea. The labs will train you on things you will need for the final project—missing out on the lab part
makes the final project much much harder. Do the labs together, all parts (unless explicitly told not to). Write it up together. It goes much faster, much smoother, and you will master the material more easily. If your partner is not helping out, bring this to our attention as soon as possible. A small intervention early is much more gentle than a big intervention later, on everyone.

If you put in the effort, you WILL pass this class. We will, however, fail you for not working along with your team. Simply put, if your team is carrying you, we will fail you out of the class.

There will be personality clashes, tempers will flare, and people will get unpleasant with each other. We will do our best to manage these conflicts, but we need to be aware of them to intercede. Again, much better early than late.

**ACADEMIC HONESTY**

Academic honesty is a requirement for the course. All assignments must be your own independent work; this includes quizzes, exams, and labs.

What is cheating? It is presenting work that is not yours as your own. You can, and are encouraged to, discuss and strategize with your colleagues on homework and labs, but your work should be your own. Copying is NEVER acceptable.

On the labs, cheating is sharing code when not explicitly told that it is permitted. If a student is caught cheating in either the class or the lab this will result in an immediate failure in the class and the lab. It will be reported to your college and your department. **DO NOT CHEAT**; it is not worth it.

**ACKNOWLEDGEMENTS**

This course is based on the Smart Product Design sequence (ME218A, B, C), and the one quarter Mechatronics class (ME210/EE118) offered at Stanford by the Smart Product Design Lab, headed by Dr. Ed Carryer.

I would like to acknowledge the tremendous help of Prof. Ed Carryer of Stanford University in teaching the subject matter to me, for all of his help with the slides, the software libraries, and the electronic hardware, and lastly for pioneering this video capture technology, and helping me to set this course up. Without his help and inspiration, this class would not be here.

I would also like to thank Texas Instruments Corp. for generously donating the bulk of the semiconductor parts for the new lab hardware, and to Microchip Corp. for donating the microcontroller boards and in-circuit programmers.

Also, I want to acknowledge the previous course TA, Max Dunne, who was spent the last three years with me redesigning, fabricating, and developing the software for the new PIC32 based hardware for this class. It was yeoman's work, and he has done a tremendous job.