Syllabus, EGR222 Mechatronics (for EE) Spring 2019

Scheduled times: Lecture: M 3-4:40, in Room: SLC222
Labs L2: W 2:00-4:50 SLC238, L5: F 2-4:50, in Lab SLC125
Textbook:W. Bolton, Mechatronics, Pearson Prentice Hall, 6th, 5th or 4th ed., but 3rd, 2nd not bad)

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Introduction:

Mechatronics is a term used to define an integrated approach including mechanical, electrical and computer systems to practical problems in engineering products and processes. Electro-mechanical systems have long relied on electrical actuators (motors, solenoids) and sensors (contact switches, electrical temperature sensors and such) along with machines to control systems ranging from manufacturing to propulsion. What is new is the availability and integration of small, inexpensive computers. While computer control in systems has been around for quite a while, it began only in relatively large scale process control in applications such as machine control in the chemical or steel industry, where the large and expensive computers of the day could be justified. But now a computer suitable for control, in the massive quantities typical of consumer electronics, can cost less than a dollar. This provides economic opportunity. Consequently, everything from a coffee maker to a phone to an automobile has embedded computers that provide control less expensively than alternative methods, and that add more functionality than could be achieved otherwise.

The automobile is a good example. Into the 70's, automobiles had only simple electrical systems, with mechanical switches to control lights, a cam driven mechanical switch to initiate spark action, and similar simple methods for other control. Engine timing relationships were fixed by mechanical linkages (the camshaft and valve system). Carburetion was likewise mechanically controlled. Then, electronics were substituted for the mechanical ignition switch. In the late 80's and 90's, small and reliable microcomputers became available and were put to work controlling not only engine ignition, but also fuel injection as an alternative to carburetion, allowing greater control and efficiency. It was possible to monitor such variables as engine and air temperature and exhaust properties, and calculate the best timing for fuel injection and ignition to give greater performance and / or efficiency. During the subsequent decades, the computation power of these computers increased greatly, as have the range of electronics in automobiles, to now include object sensors and navigation systems, with self driving cars trying to edge into the mainstream. Automotive control electronics seemed poised for another leap: electronic control of valves, replacing the camshaft. But that seems to be on hold as fully electric cars (with computers controlling the motors) become more common. Hybrid vehicles include electric and electronic control even in transmission of power to the wheels and braking, all yielding efficiency and other benefits.

Similar changes are becoming pervasive. For example, the U.S. Navy has gone to all electric propulsion systems the "Zumwalt" and "Ford" class vessels, and will do so for weapons (lasers and rail guns) as well. Fixed and autonomous robotic systems will become used in more applications. This is an important part of the Army's concept of the battlefield of the future. Consumer electronics will become more computer driven (cameras are a good example of how this happens). The degree of control in systems will also change. This same increase in computer power will make possible practical vision systems for self-driving cars (perhaps the most immediate yet demanding application) and many others (like massive surveillance systems), limited primarily by the imagination of engineers designing systems.

For that reason, it is important that all engineers have an understanding of the basic elements of mechatronics, including not only elements of your own discipline (mechanical or electrical) but also of the other, and the concept of how small embedded control computers operate and can be applied to such systems.

Objectives:

1. Provide students an understanding of mechatronics principles and concepts.
2. Develop an appreciation of sensors and sensor conditioning, with practical applications in the lab.
3. Develop an appreciation of actuators and electronic controls, with practical applications in the lab.
4. Acquaint students with an appreciation of component and system modeling issues.
5. Develop an appreciation of microprocessors and computer control, with practical applications in the lab.

Course structure:

The course includes a two-hour lecture and a three-hour laboratory session each week. These two components are intended to complement each other. The emphasis will be at the interfaces between the electrical and mechanical domains. We start with basic electro-mechanical sensors and actuators, combining these into relatively simple systems. Later, we integrate in the use of a microcontroller that will substitute for control circuitry. Then, we reprogram the microcontroller to perform more complex functions. In the laboratory, students will work in groups of two. The lecture material supports the lab experience, which is where you will really learn the material.

About This Particular Offering:

It is expected that EGR222 will be split into separate EE222 and ME222 course listings (as was true when the course was created). The 2019 offering is a transitional measure, with much of the material remaining the same, but with variations particularly focused on either EE or ME. This section (lecture session EGR222 B) is designed and intended for EE students, as are the associated L2 and L5 lab sessions. These will all be taught together as an integrated course. Because of scheduling idiosyncrasies, some students may not be able to find seats in the correct session corresponding to their major. It is allowable (at least by the EE and Physics department) that EE students can enroll in either the EE or ME sections of the lecture or lab or both if they cannot enroll in the EE version of the course. ME and EGM students need to check with their advisor to see if this is also allowable for them.

Theses EE oriented sections of EGR222 will somewhat de-emphasize some mechanical aspects. I am expecting a somewhat reduced emphasis on sensing mechanical position and temperature, and will put less emphasis on mechanical actuation. There will be additional emphasis on the electrical and electronics of motor control, especially for “brushless” DC motors (which are actually synchronous motors with automated switching circuits). We will also put more emphasis on microcontroller programming, using the microcontroller’s timer resources to control pulse width modulated waveforms.

Lecture Schedule: (subject to variations as needed)

wk	dates	topic	readings*
1	Jan 14	Introduction, Sensors and Transducers	Intro, Sensors Chapters
2	Jan 28	Sensors and Transducers: measuring things	Sensors Chapter (continued)
3	Feb 4	Signals: representing things as voltages	Sensor Conditioning Chapter
4	Feb 11	Data representation, Switching circuits	Electrical Actuation Chapter
5	Feb 18	Electrical actuation (motors)	Motors material
6	Feb 24	Microprocessors	Microcontroller Chapter
7	Mar 11	Microprocessors, C programming	above, plus Test #1
8	Mar 18	System modeling	System Modeling Chapter
9	Mar 25	Electric motors: AC, steppers, brushless	Electrical Actuation Chapter
10	Apr 1	Microprocessor Input/Output	Microcontroller materials
11	Apr 8	Microprocessor Timers, Interrupts	Microcontroller materials
12	Apr 15	System modeling	System Modeling Ch.
13	Apr 22	Computer control	Control Material, Test #2
14	Apr 29	System modeling, response overview	System Response Material
		Exam	Exam

Note about the book and readings:

The textbook is ridiculously expensive. Older editions may be less so. But, it's one of the few books available on the subject, and it is pitched at an introductory level appropriate for this course. Perhaps you are wondering if you should even bother buying it. The answer is "yes." The readings are worthwhile. The lectures will not cover everything; they can't. This is too wide a subject. In addition, the book goes farther than we will be able to in many directions. It has more on mechanical actuation than we can cover. We don't have time to get into pneumatics and hydraulics, and the symbols used to represent such systems, at all. The book is a good introductory resource for such things. Material to support the microcontroller we are using (The NXP/Freescale S08SH8 most likely) will be distributed in handouts, and you can find materials online or on the course website or the CD that comes with the microcontroller kit.

The second reason to purchase the book is that the tests are "open book." If you want to look something up in a book, you will necessarily need to have one. I will not be allowing students to pass books back and forth for reference during a test, or use computers (no eBooks!).

But, having said that, it's not necessary to have the latest edition. There's not much difference between editions 2 and 3, the errors I know of were not fixed. Edition 4 reorganized the chapters, and has some other improvements. The newer editions do have some additional coverage, for example the 5th edition has a chapter on Artificial Intelligence. Because of the chapter differences, I have not listed readings in the schedule by chapter number. Rather, you should look at the topic being covered and read the appropriate sections of the book for that topic.

Lab Schedule:

1	Jan 16-18	Sensors: Temperature, LVDT linear position		
2	Jan 23-24	Sensors (continued)	(Written)	6%
3	Jan 30-Feb1	Laboratory kit intro and component familiarization	none	
4	Feb 8-8	Inductive sensor (Be sure to get a head start on this!)	(in lab)	3%
5	Feb 15-17	DC Motor characteristics, optical tachometer		

6	Feb 20-22	DC Motor characteristics, optical tachometer (continued)	(Written)	6%
7	Feb 27-M1	Microcomputer startup, including stepper motor	demonstration	2%
8	Mar 13-15	Electro-mechanical torque, speed control of DC motor	(in lab)	4%
9	Mar 20-22	Electro-mechanical position control of DC motor		
10	Mar 27-29	Electro-mechanical position control of DC motor (cont.)	(in lab)	6%
11	Apr 3-5	Microcontroller serial port, comms, timer driving motor	(in lab)	3%
12	Apr 10-12	Computer A/D converter, motor speed control(start)		
13	Apr 24-26	Computer PWM motor speed control(final)	(in lab)	5%
	Apr 17, May 1	Make-up dates if needed		

Some additional comments about the course:

The subject of Mechatronics has enormous span, and there is simply no way that we can cover all that we would like to know about it. Indeed, since this course is being offered in the 4th semester of the current curriculum, many of the topics that might be considered within the scope of mechatronics, including electronics, machine design, and control theory, have not yet been covered in other courses. In some schools, mechatronics is considered a "capstone" course that is taken after you have all of many prerequisites. Instead, we are offering it early in the curriculum, so that students become familiar with the kinds of things we want to do. Hopefully, that will motivate later courses which deal with component subjects in greater rigor. For example, we will build relatively simple electronic circuits, but we will not attempt to give them the highest possible performance, or the best frequency characteristics. To do that requires electronics knowledge beyond what we can include. In like manner, we will control electro-mechanical systems. But we will not do so optimally, or with the best response characteristics. To do that we need control theory, which is, again, beyond the scope of this course. What we will do with the computer barely scratches the surface of capability, even for this very low-end microcontroller. We do hope that this course will excite your imagination about things that can be accomplished with engineering. You may not know everything that you need to build your dream project, but you will have a notion of where to go and what to study to get there. Ultimately, the biggest limitation on what engineering can achieve is the human imagination. We hope that this course will excite you with ideas of things you can do.

Team Teaching:

This course will be taught by John Gilmer and Shi Sha. While these instructors are assigned different responsibilities, the course will be taught as an integrated whole. If you are taking some portion of the course in one of the ME sections, lab grades will be forwarded to Dr. Zhu for mid-term and final grades, and I will expect to receive lab grades from him or any other ME section instructor in like manner for students in my lecture section.

Laboratory Report Policies:

The laboratory exercises will be graded based on submission of materials at the end of the lab session (for informal reports on supplied forms and demonstrations) or at the beginning of the following lab session (for the written informal reports). Assignments are to be completed and submitted on time. Late assignments will only be accepted in exceptional circumstances, after contacting the instructor concerning the particular case and obtaining agreement. The written reports are all informal, in some cases with only selected materials such as a schematic or table of measurements included. The Lab assignment includes instructions on what is required in these cases.

For the lab exercises requiring a submission on a form at the end of the lab period, think of these sessions as being like a practical exam. If you do not finish, you will lose credit for what you did not complete. Come prepared. You should do some of the circuit construction and testing ahead of time whenever possible. If you have not read and mentally prepared for these sessions, you may well not finish, and will receive a poor grade as a consequence.

There are six "informal reports" which require a written submission upon completion of the lab exercise. It is expected that each partner will do three of these, but the other partner should help review the report, and is thus considered partially responsible, and will receive a grade for that report as well as his own.

Informal reports: Selected materials, or fill-in-the-blanks on forms provided for the assignment. If no form is provided, the report is to be similar to those used in EE283, and due at the beginning of class the next week.

Formal report: A full written report including description of approach, design, results, etc. We do not currently include formal reports in this course.

Demonstration: Demonstrate the correct operation to the instructor in the laboratory. If a demonstration fails to work, an informal report consisting of the schematic/ diagram and description of the problem is to be submitted instead. A correct demonstration receives a grade of 100 in the absence of any shortfalls. A demonstration that functions but has flaws, inadequate in conformance to standards, is messy or poorly organized, or is not fully correct, will receive a lower grade. A demonstration that fails can be re-worked for the following week. If so, it is to be accompanied by an informal report. The grade will reflect the failure to function properly on time. Deductions are made for failure to properly color code wiring, messy or poorly routed wiring, failure to use bypass capacitors properly, or other details where instructions have not been properly followed.

Grading:

All material will be graded on a basis of 0-100, with some graded material allowing for grades higher than 100 with bonus items (usually up to 10% extra) considered. On tests and reports, questions or other items may be "compensated" if large numbers of students miss them (indicating possibly a badly posed question or inadequate coverage of the topic). On such questions, some proportion of the "lost" credit will be returned. This is the only form of "curving" of grades in the course.

All written work is expected to be neat and well presented. A penalty of up to 10% will be assessed for poor presentation on any written work, with the consideration being larger if the quality of writing renders portions of the report not understandable. The grades from all work will be weighted as given in the table below, totaled, and converted into the Wilkes 4.0 scale grading system using the conversion table following.

90+: 4.0	87-89: 3.5	80-86: 3.0	77-79: 2.5
70-76: 2.0	60-64: 1.0	65-69: 1.5	below 60: 0.0

The allocation of credit for various graded work is as follows:

2 Tests	15% each	1-2 pop quizzes	4% total
1 Final Examination	28%	Class participation	3%
Laboratory work	35% total (see schedule)		

All graded material handed in is to be the student's (or the student partners', for lab assignments) own work. A student may get help from another student (or partnership, for lab work) or anyone else in matters of technique or background. You are not to copy another student's design, but you are allowed to help another student reason out a design. You are allowed to give suggestions for approaches, and help other students with mastery of tools and techniques. Do your own work, and report results from what you do, not what someone else does. You are not allowed to electronically copy or even look at another student's graded work, even as a "starting place" for your own. Evidence of copied results will be rewarded by zero grades on the concerned material or more serious sanction if the situation merits such action. If you are in doubt as to whether some form of interaction is appropriate, ask your instructor.

A student will share the grade of his own informal lab report and his partner's, to which he contributes both in the lab exercise itself and in reviewing and helping with the lab report. There are two "written" informal reports which will require analysis and/or calculations outside of the laboratory. Both partners should contribute to each written report since each team member will receive the same report grade. However, the primary responsibility for the first written report (Sensors) is assigned to the partner whose last name appears first alphabetically; the other partner has primary responsibility for the second written report (Motor Characteristics). (The instructor is free to make other arrangements.) A student who does not submit his assigned written report will earn a grade of zero for both written reports (It is possible that you will get stuck with a really bad lab partner. If that happens, and your grade is more than 10% above that of your partner for a pair of labs for which responsibility alternates, the damage will be limited to no more than 10 points. If your partner fails the course or withdraws, his lab grades will not be counted at all for you, but will be factored out with other material counting slightly higher.

Tests, Quizzes, and Final Exam:

All tests are open-book, open-notes. The use of calculators is allowed. The use of computers and communications equipment (e.g. cellular telephones or radios) is not allowed. (No exception is made to the rules against using a computer if you have an "electronic" copy of the book; only printed physical copies are allowed for a test. Consider this purchasing the book.) Test questions will include a variety of short answer, short essay, and design and analysis problems. They will be hard. Come well organized and prepared. One or two pop quizzes may be given. These will be similar to the tests but shorter. You should be sure to bring your book, calculator (with healthy batteries), and notes to each class in order to be prepared for the possibility of a pop quiz. (If no pop quiz is given, the final examination credit will rise to 29%.)

More about Laboratory Reports:

The purpose of a report is to communicate effectively the results of the exercise. Part of the purpose of the lab report is to give the student an opportunity to demonstrate an ability to organize and format a report effectively to convey the essentials of the results concisely. Thus, the reports are expected to be relatively short and to the point, with a minimum of text and procedure. For example, the lab report is not to include a detailed account of all the steps that were required to connect components to build the system; the schematics and diagrams should convey that information quite adequately. Raw or intermediate data or techniques used to derive the result should only be included when they are unusual or innovative, presented special problems, or are specifically called for. Generally, such details are given in a summary form, or in an appendix if extensive. Examples of intermediate results or techniques that may be included are test circuits, unusual voltage observations, or aberrant behavior. Inclusion of excessive material can have a negative effect on the grade given. You should conform to the usual conventions (established in EE283) for figure and table numbering and titles, the use of callouts, proper marking and labeling on graphs and schematics, and such. Refer to the *Engineering Laboratory Reports Manual* distributed in EE283 for further general guidance. If you are in doubt about such issues, ask.

Part of performing the exercise and writing the formal report is determining the format for the presentation of data (if necessary) and results. This is typical of the problem facing a working engineer, where in the workplace there often is no specific format or form for a report. In their reports, students should conform to engineering practices as described in the texts for this class and others. For example, schematics of circuits should all conform to such standards: show signal flow left to right, grounds toward bottom, use pin numbers, identify devices as R1, C1, L1, etc. as appropriate. A verbal description is only necessary to the extent that the tabular and symbolic descriptions fail to convey some essential point, or discussion is needed to clarify some point, for example the overall function of a complex machine.

Every laboratory report should include a very brief "success" statement, usually in the abstract and in the conclusions, that the system operated correctly or that the desired phenomenon was observed, giving the date correct operation was observed by the instructor, if applicable. Should the exercise not be successful, a section will instead describe the manner in which the system or experiment failed, and include an analysis of the causes of failure and corrective actions necessary. Such a "failed" lab exercise report can be resubmitted within a week in revised form for additional credit if further work after the due date results in success. Failure to mention successful operation will be graded as a circuit that fails to operate, in addition to a deduction for not including such a statement.

You may think that it will help you not to mention that a system or exercise failed, and that the instructor will assume success unless you say otherwise. That is not the case. Any indication that the student is trying to hide the truth of this matter will elicit a very negative response. In the business world, hiding the truth from a manager prevents him from doing his job properly, puts a project at greater risk, and is a much more serious offense against the company and customer than merely failing to accomplish a technical objective. Usually, this kind of thing will get you fired.

Lab reports will (unless other grading policies are given by your instructor) usually be graded 30% on successful completion (as demonstrated in the lab), 30% on the results (accuracy and correctness), and 40% on format, presentation, selection of material to present, and aesthetics of the report. Sloppy work will be appropriately rewarded. If a report is so sloppy or poorly written or has serious omissions, such that the "content" is unclear, than the penalty may well exceed the nominal 40% indicated. In extreme cases, it may be rejected and awarded a grade of zero. If the student omits a "success" (or lack of same) statement and explanation, the penalty may be greater than the 30% for unsuccessful completion, since this may be regarded as an error of results (30%) and organization (40%) as well.

All formal written submissions of reports are expected to be prepared with computer prepared graphics and texts unless instructions indicate otherwise. For this course, there are no “Formal” reports, but lab instructions may call for some parts of a submission to be computer prepared on informal reports. Note that the "Logicworks" simulation package used for EE241 or PSPICE or LTSpice used for EE251 are good tools for preparing schematics, although a simple "Draw" program such as those included on many computers will do just as well and in some respects better. Students are expected to use such computer based tools for formal assignments. However, figures directly from such packages may sometimes be less than completely adequate, and you may need to do a final edit in a graphics program before pasting the figure into your report. For example, figure titles and legends may not be correct for a lab report format (e.g. at top instead of below), and need to be removed or replaced. You need to make sure annotations are correctly sized. You can summarize grounds and power for all IC's in a table, in order to avoid cluttering your schematic with power connections. You should normally use discrete gate parts rather than multiple gate IC parts so that the schematic circuit will be clearer. Be sure to label all parts, e.g. U1, U2, etc. for IC's. This is especially important for IC's which have multiple gates in different places in your schematic. You must indicate pin numbers as well. Remember, the purposes of a schematic or diagram is to communicate and document what you have done as clearly as possible. Ask yourself if your figures do that. Hand drawn figures and graphs are satisfactory for submissions turned in on the same day as the lab (with forms). You can also print graphs, tables or schematics to the lab printer and attach those to your form report rather than fill out form tables by hand. Refer to the *Laboratory Reports Manual*.

Homework and Class Participation:

Homework will be assigned, and collected. There will be about 5 such homework assignments. On the due date, the homework will be collected and a solution set passed out. Questions and discussion concerning the homework will follow. The submitted homework will not be graded. It will be reviewed, and on a selective basis some students or some questions may be examined in detail. The effect on a student's grade from homework is in the "class participation" category. I will be tracking who does the homework and the degree of seriousness with which it is taken, including evidence of whether the solutions may have been copied. Along with class and lab attendance and tardiness, homework submission will be considered when assigning a number for a subjective 3% of the grade for "class participation." If reserve materials at the library are not returned in a timely manner, this can also affect class participation, and failure to return materials at all will result in a significant decrease in the final grade. In addition, students are expected to read this syllabus. As evidence that you have read it, send an e-mail to your lecture instructor using the e-mail address given at the beginning of this syllabus stating that you have read it. This must be done before the second class or 1% will be deducted from the "class participation" part of your grade, in addition to deductions for homework and attendance. (And, yes, I will allow the "participation" grade to go negative, meaning it would be equivalent to taking a zero on a lab exercise counting more than the normal 3%.)

When you do homework, keep in mind that I will be looking more at what you did to get your answer, more so than at the answer itself. So, your problem solutions should be clear, understandable, and show all of the steps taken. Show your logic, and give units and annotate what you do. Use units! If I don't see much to indicate how you did a problem, I will not be able to credit you with much level of effort toward the homework, even if you wrote down the correct answer. Use diagrams, and write text in explanation. This is good practice for professional problem solving, where you must demonstrate that your answer is correct, not merely give a number or some other form of cryptic result. (In industry, when you do a project, usually nobody else knows the correct answer. That's why you are doing it. So, how will your supervisor or client know if you are correct? They will have to follow your steps and see how you got the answer. If you can't convince others your work is correct, it is worthless. Start practicing this now.)

Absences:

Attendance at class and in the laboratory is not optional. Absences will cause deductions from the class participation part of the grade. More than two absences in either the lab, the lecture, or the two combined, unless explicitly excused for reasons accepted by the instructor, will result in a zero grade in the course. Excused absences include illness as certified by a physician, trips attendant to professional conferences, or family emergencies certified by the Dean of Students, or as specifically allowed and excused by the instructor. If at all possible, submit a message in advance to your instructor of anticipated absences. If you cannot contact the instructor, contact the EE and Physics administrative assistant Mrs. Nikki Stapleton in an emergency. If you have missed a class for an unexpected reason, contact your instructor ASAP. I will usually call roll at the beginning of class. If you miss roll call, I count that as an absence for purposes of class participation. If you can demonstrate that you were present but tardy, for example by having submitted the homework due on time, I will not count "tardy but not absent" as one of the two absences that will result in a zero. But the burden is on the student.

Lab Kits:

Every pair of students who are partners for the lab component of this course will need a lab kit from EE241, which includes such things as a solderless breadboard, meter, pliers, wire cutters, power supply, alligator clip jumpers, and a variety of small components. (If that turns out not to be the case, the needed components of the kit will be provided. Please let your lab instructor know.) In addition, a lab kit will be needed for this course. That lab kit includes additional electrical and mechanical components that we will be using, including a microcontroller "demo board" and related components. Until this kit is distributed (probably during Lab session 3), needed additional components will be supplied in the lab. The microcontrollers will be issued later in the course when we get to that material in February.

The microcontroller:

We will be using the Freescale S08QG8 or S08SH8 microcontroller. This one chip stand - alone microcomputer is suitable for embedding into mechatronic designs. It and similar microcontrollers are widely used in many applications. Further information and documentation can be found at the NXP / Freescale (formerly Motorola Semiconductor) web site, including manuals. You should download the S08QG8 or SH8 (as applicable) manual; it's about 300 pages, and reference to it will be necessary. We will be using a "Demo" board from NXP / Freescale which includes a microcontroller, a few LED's, pushbuttons, a potentiometer, and a photocell, already integrated with debugging support hardware. The demo board (DEMO9S08QG8 or DEMO9S08SH8 is the product name) will remain part of the laboratory property, and you will turn it back in at the end of the semester. If you want your own, they can be purchased for $100 each from Freescale. (Ask your lab instructor if he'll make you a better deal for a used one.) The HCS08QG8 or SH8 has 512 bytes of RAM and 8K bytes of Flash PROM (electrically erasable programmable read only memory) used to hold programs. It has thirteen (or 17 for the SH8) I/O lines. An Analog to Digital (A/D) converter can sample up to eight 10 bit analog signals, and other signals can be used to form a serial interface (e.g. RS232 interface to a PC).

For Lab 7, we will do the exercise using the demo board, with electrical connections from the demo board to your solderless breadboard to drive LEDs and a stepper motor. In the last two exercises, we will use the demo board for programming and debugging support, but your microcontroller will be taken off the demo board and plugged into your breadboard instead. Once programmed, it will run independently without needing the demo board.

We will do our programming in assembly / machine language and C. We will use the “Code Warrior” Integrated Development Environment (IDE) running on the PC. The lab computers will be configured to do this, but you are encouraged to download “Code Warrior for Microcontrollers” (from the NXP / Freescale web site) or load it onto your own computer from the CD that comes with the lab demo board. The environment runs under Windows. We will be running it under Windows 7. Students have been able to get it running under other Windows systems. We need Codewarrior 10.x (instead of 6.x that comes with the kit) and once used with this, the microcontroller demo board can no longer run with an XP system without giving error messages.

The programs we will be using and writing will be very simple (given the scope of the course). We will learn enough of Assembly and C programming to do what we need to do. This is not a programming course in the sense of a typical computer language course. Machine language is the binary bit patterns that are actually stored as a program in the computer’s memory, and that the computer directly executes. That is what we need in order to run. Assembly language is the same thing, but using symbols like "ADD" instead of the binary bit pattern to say "Add to the Accumulator A". The text has an introduction to assembly language, and includes material on other microcontrollers, but is somewhat similar. This will be supplemented by material provided as notes and from documentation.

Other microcontrollers and boards are being used for EE247: Programming for Embedded Systems and EE342 Microcontrollers. Those are much larger, more complex, and require more sophisticated programming (Kinetis family devices KL29Z and KL43Z).

Initial laboratory Exercises:

At this writing, the room for the EGR lab for Wednesday (L2) and for the lecture have not been assigned. EGR222 L5 will be in SLC125. EE222L2 will probably be in SLC238. Normally EGR222 begins with temperature sensing, but if those resources are already committed to the EGR222 lab sessions in SLC125, and we have to use a different lab in SLC238. We will do the mechanical position sensing lab instead, then do temperature the following week. By the time of the first lecture these issues should be sorted out. Lab handouts will be distributed during the first lecture class January 14 most likely, and emailed earlier if possible.