Mechanical & Materials Engineering
Engineering Building, Suite 400
www.me.pdx.edu
503-725-4290

Course:	ME 121, Introduction to Systems and Control
Credits:	3
Required/Elective:	Required
Prerequisites:	ME 120
Meeting times:	Section 2: CRN 65713, M-W, 2:00 PM – 3:50 PM
Web site:	http://web.cecs.pdx.edu/~me121
Instructor:	Dr. Lemmy Meekisho, lemmy@pdx.edu
TA:	Graham Freedland, gaf2@pdx.edu

Course Description

ME 120, ME 121 and ME 122 constitute an introduction to skills, modern tools, teamwork, design methodology and professional practices of typical engineers. In ME 121, students learn to use mass and energy balances to design temperature and salinity controller for a closed loop water system. They develop stronger programming skills (building on skills developed in ME 120), sensor input, sensor calibration, and on/off control of heaters and solenoid valves. They use written and oral communication as part of assignments and class projects.

Textbook and other required course materials

There is no textbook. Reading materials and class notes will be provided on the class web site. Students are required to have their own laptop computer that they bring to class. Specifications for the laptops are given below. Students must have the microcontroller project kit from ME 120 called the SparkFun Inventor's Kit for Arduino. Students are required to buy a 20x4 character LCD panel available at the Portland State Bookstore.

Computer Requirements

Students are required to have their own laptop computer. Laptops running the latest versions of Windows, or Macintosh operating systems are acceptable. Regardless of the operating system chosen, students are expected to be able to maintain and use their computers to complete the homework assignments in the class. The instructors and Teaching Assistants cannot offer tutoring or system maintenance support. Students will need to have a recent version of the Microsoft Office software suite. Students will need to run Excel, PowerPoint and the Arduino Integrated Development Environment (IDE) during in-class exercises and presentations. Students will need to demonstrate proficiency with Excel during quizzes and exams.

The Maseeh College has two general purpose computing laboratories in room EB 325 and FAB 55-17. See `cat.pdx.edu/students/labs.html` and `cat.pdx.edu/labstatus` for more information. Solidworks and MathCAD are installed on the computers in the EB 325 lab.

Toolkit

Students will need to use the hand tools they obtained for ME 121 to complete homework assignments and in-class exercises. Students are expected to bring the tools to class. The list of tools is specified on the ME 121 website. Students will need to purchase a small DC power supply and other miscellaneous supplies to complete the fish tank project. Other supplies will be provided and are covered in the course fee.

Liability Release

Students will be working with hand tools, power tools and electronic equipment during class, and as part of completing homework assignments and projects. Students will be provided instruction in the safe use of these

tools and equipment. As a condition of taking the class, students must agree to sign a form that releases Portland State University and its staff from liability for injury caused during the use of the equipment.

Course Learning Objectives:

At the completion of the course, students must…	**ABET Program Outcomes***
1. Be able to analyze DC circuits with Ohm's law, and Kirchoff's voltage and current laws	a
2. Be able to build and debug electrical circuits on a breadboard	a, b
3. Be able to write and debug programs for the Arduino microcontroller platform that read data from sensors and control transistors, relays, solenoid valves and heaters.	a, k
4. Be able to read hand sketches and machine drawings.	a, c, k
5. Be able to use SolidWorks to make three-dimensional solid models, dimensioned part drawings, and assembly drawings.	c, k
6. Be able to safely and effectively perform drilling operations with a manual milling machine.	k
7. Be able to fabricate flow loop components and assemble those components in to a working flow system controlled by solenoid valves.	k
8. Be able to perform mathematical analysis and plotting with Excel and MATLAB.	b, k
9. Be able to calibrate sensors and obtain calibration curves using least squares curve fits.	b
10. Be able to make presentations and short written reports in a professional format.	g
11. Be able to work in teams to complete projects that involve fabrication, assembly and testing of electromechanical systems.	d
12. Be able to apply mass and energy balances to closed and open flow systems.	a, c, e

*Program Outcomes are Learning Outcomes for the entire BSME Program. Refer to the standard ABET learning outcomes listed at http://www.me.pdx.edu/programs/undergrad/objectives.php. Outcome "a" is " An ability to apply knowledge of mathematics, science, and engineering", Outcome "b" is "an ability to design and conduct experiments, as well as to analyze and interpret data", etc.

Course Grading

Assessment	**Percent of Total Grade**	**Comment**
Homework	10 %	Some assignments are individual and some are done in teams. On team assignments, all team members get the same grade
Quiz	10 %	
Online quizzes	5 %	
Midterm	20 %	
Final Exam	25 %	
Fish Tank Project	20 %	Completed by teams of four
Peer Review	10 %	

Incompletes: A grade of "I" is granted by the instructor *only* with prior approval and consent. Criteria are outlined in the PSU Bulletin. Poor performance in the class is *not* a valid reason for granting an I (incomplete).

Program requirements: Admission to the BSME program requires a grade of C or better in ME 121. Additional GPA requirements also apply as described in the PSU Bulletin.

Late Policy

Homework must be submitted at the beginning of class, on the day it is due.

Any work turned in late will be graded as:

- Maximum of 80% of the grade if turned in less than 2 hours after beginning of class
- Maximum of 50% of the grade if turned in the same day (before 11:59pm)
- 0% if turned in after the due day.

Course Schedule

Readings, lecture notes, homework assignments and other materials will be distributed by posting to the class website.

Topics Covered

The following list shows the topics covered in each class meeting. Note that this schedule may change during the term as necessary to insure student learning.

1 Course organization, project overview, tools and equipment review, fabrication of conductivity sensor, introduction to MATLAB
2 Saltwater chemistry, fabrication of PVC fish tank, plotting with MATLAB
3 Saltwater chemistry, fabrication of platform for the fish tank assembly, MATLAB scripts
4 Saltwater mixtures, conditional code execution (“if” constructs) in Arduino code
5 Finish fabrication of flow loop, begin calibration of conductivity sensor
6 Quiz 1. Calibration of conductivity sensor, least squares fitting with MATLAB
7 Wiring harness for LCD display, Arduino programming for LCD display
8 Mass balances, Arduino programming for LCD display, transistor switching
9 Cascaded switching of relays and solenoid valves, introduction to algorithm for controlling salinity
10 Midterm exam
11 Programming for control of fish tank salinity
12 Debugging and performance testing of salinity control program
13 In-class verification of salinity control
14 Fabrication of thermistor probes, voltage divider circuit for thermistor measurements
15 Calibration of thermistor probes, least squares analysis of thermistor calibration data
16 Fabrication of heaters, introduction to energy balances and heater control logic
17 Arduino program for heater and salinity control
18 Debugging and performance testing of fish tank control programs
19 In-class verification of fish tank performance.
20 In-class verification of fish tank performance, Course review.

Computer and E-mail Accounts

If you haven't done so already, please go to the CATLab located in EB 325 to activate your engineering account. If you need help in using this account, please see the attendant or send an e-mail to support@cecs.pdx.edu

You should regularly check your CECS e-mail account (yourname@cecs.pdx.edu). Important information and announcements are delivered to that e-mail address. If you wish, you can forward your CECS email to another email account that you check regularly.

Code of Conduct

The PSU Student Conduct Code prohibits all forms of academic cheating, fraud, and dishonesty. Details can be found on the PSU web page for the code of student conduct, http://www.pdx.edu/dos/codeofconduct. Allegations of academic dishonesty may be addressed by the instructor, and/or may be referred to the Office of Student Affairs for action. Acts of academic dishonesty may result in a failing grade on the exam or assignment for which the dishonesty occurred, disciplinary probation, suspension or dismissal from the University. Questions about academic honesty may be directed to the Office of Student Affairs: http://www.ess.pdx.edu/osa/).

Classroom Rules and Behavior Expectations

The classroom is a professional space and professional conduct is expected. Please silence your cell phone and refrain from text messaging during class and exam times. Treat your fellow students and the instructor with respect and please use appropriate language at all times. Additional rules may be added at the instructor's discretion.

Ethics and Professionalism

As future professional engineers you should plan to take the FE Exam (see the Oregon State Board of Examiners for Engineering and Land Surveying at www.osbeels.org), and you should be familiar with the ASME Code of Ethics (http://files.asme.org/ASMEORG/Governance/3675.pdf), which includes the following:

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

1. *Using their knowledge and skill for the enhancement of human welfare;*
2. *Being honest and impartial, and serving with fidelity their clients (including their employers) and the public; and*
3. *Striving to increase the competence and prestige of the engineering profession.*

Campus Resources

As a PSU student, you have numerous resources at your disposal. Please take advantage of them while you are here. A small sample is listed below:

- MME Website: http://www.me.pdx.edul
- Career Center: http://www.career.pdx.edu/
- Center for Student Health & Counseling: http://www.shac.pdx.edu/
- The Writing Center: http://www.writingcenter.pdx.edu/
- PSU Disability Resource Center: 435 SMU - The PSU Disability Resource Center is available to help students with academic accommodations. If you are a student who has need for test-taking, note-taking or other assistance, please visit the DRC and notify the instructor at the beginning of the term.

Student Groups and Professional Organizations

Participation in student and professional groups can be a valuable part of your education experience. Membership gives students opportunities to get to know fellow students better, meet and network with professionals, collaborate in solving real engineering problems, learn about internship or job possibilities, socialize and have fun. Consider becoming active with a student organization, such as the following:

- American Society of Mechanical Engineers Student Group (ASME): http://web.cecs.pdx.edu/~asme/
- Society of Automotive Engineers: Viking Motorsports: http://vms.groups.pdx.edu/
- Engineers without Borders: http://www.ewbpsu.org/

Most professional organizations have monthly meetings and encourage student participation by providing discounts for lunch and dinner meetings. These meetings provide opportunities to network with potential future employers, learn about scholarships, and increase your technical knowledge. Take a look at these organizations as a starting point:

- American Society of Mechanical Engineers (ASME) Oregon Section: http://asmeoregon.wordpress.com/
- Society of Automotive Engineers, Oregon Chapter: http://www.oregonsae.org/
- Society of Women Engineers (SWE) Columbia River Section - http://www.swe-columbia-river.org
- Engineers without Borders, Portland Chapter: http://www.ewbportland.org/

Library and Literature Research

Ubiquity of the Internet makes it very tempting to think that all necessary resources for a term project will be available in full text after typing in a few words at google.com. This is not the case. You will often need to go to the library, use library search tools and read physical books and articles contained in refereed/archival journals.

Be sure to make use of the Vikat library catalog accessed via the PSU library home page at http://www.lib.pdx.edu/. Also available on the library home page are Full Text Electronic Journals and a list of on-line Databases. Databases to try are EI Compendex (http://www.ei.org/ev2/ev2.home) and Lexis-Nexis. Access to these databases is free for PSU students, but you must be using a computer on campus or via a proxy over an Internet connection. To log on to the PSU proxy server use https://login.proxy.lib.pdx.edu/login.

Campus Safety

Student safety is paramount. The Campus Public Safety Office is open 24 hours a day to assist with personal safety, crime prevention and security escort services. Call 503-725-4407 for more information.

For Campus emergencies call 503-725-4404.