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

Portland State
UNIVERSITY

Course:	EAS 199A, Engineering Problem Solving 1
Credits:	3
Required/Elective:	Required
Prerequisites:	College Algebra
Meeting times:	Tuesdays and Thursdays, 2:00 – 3:50 PM
Web site:	http://web.cecs.pdx.edu/eas199/A
Instructor:	Gerald Recktenwald

Course Description

EAS 199A, 199B, and 199C provide an introduction to skills, modern tools, teamwork, design methodology and professional practices of a typical mechanical engineer. In EAS 199A, students learn to analyze, fabricate and troubleshoot electromechanical systems. Students learn programming and solid modeling. 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 are 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 purchase a microcontroller project kit called the Arduino Inventor's Kit. The kits are available at the Portland State Bookstore.

Performance Assessments

Student achievement of learning objectives is assessed with homework, quizzes, exams and projects using the weighting scheme shown in the table to the right. Weekly assignments require students to bring working programs and/or circuits to class. Exams will require students to show knowledge by writing programs and building circuits. Students will complete two projects – a desktop fan, and a water pump – that will involve design analysis, fabrication, testing, and in the case of the desktop fan, programming. These projects will be completed in teams of two, with both students sharing the same grade.

Homework	20%
Quizzes (2)	20%
Midterm exam	20%
Fan Project	10%
Pump Project	10%
Final exam	20%

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 support for operating system maintenance. Students will need to have a recent version of the Microsoft Office software suite. Students will need to run Excel, and PowerPoint during in-class exercises and presentations. Students will need to demonstrate proficiency with Excel during quizzes and exams. Students will need to use Solidworks to complete homework assignments.

The Maseeh College has two general purpose computing laboratories, one in Engineering Building (EB) room 325 and the other in Fourth Avenue Building (FAB) 55-17. See `cat.pdx.edu/labstatus` and `cat.pdx.edu/students/labs.html` for more information. Solidworks and Microsoft Office are installed on the computers in the EB 325 lab.

Toolkit

Students are required to assemble a set of hand tools to be used in completing homework assignments and in-class exercises. Students are expected to bring the tools to class. The list of tools is specified on the class website, http://web.cecs.pdx.edu/eas199/A/equipment.

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. This equipment is typical of that used by practicing engineers and engineering technicians in the normal course of performing their job duties. 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

Learning Objectives:

The following table lists the learning objectives for the course, and the corresponding ABET Program Outcomes. Students who successfully complete the course will be able to demonstrate the learning objectives. ABET is the Accreditation Board for Engineering and Technology (www.abet.org) that establishes nationwide standards for engineering programs. The table shows how the specific goals of this class relate to the larger objectives of the BSME program, and hence the ABET Program Outcomes. A list of ABET Program Outcomes is available at http://www.me.pdx.edu/programs/undergrad/objectives.php.

	Learning Objectives: *Students must demonstrate the ability to:*	**ABET Program Outcomes**
1	Analyze DC circuits with Ohm's law, and Kirchoff's voltage and current laws	a
2	Build and debug electrical circuits on a breadboard	a,b
3	Write and debug programs for the Arduino microcontroller platform, and to use those programs to read data from sensors and to control LEDs, transistors and motors.	a,k
4	Read hand sketches and machine drawings.	a, b, k
5	Use Solidworks to make two-dimensional sketches, three-dimensional solid models, dimensioned part drawings, and assembly drawings.	c, k
6	Safely and effectively perform drilling operations with a manual milling machine.	k
7	Fabricate small mechanical components and assemble those components in to a working electromechanical systems.	k
8	Perform mathematical analysis and plotting with Excel.	b, k
9	Apply principles of mass and energy conservation to the operation of a centrifugal pump	a, e
10	Measure performance of a water pump, and analyze the results using least squares curve fits.	b
11	Make presentations and short written reports in a professional format.	g
12	Work in teams to complete projects that involve fabrication, assembly and testing of small mechanical systems.	d

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. Introduction, Ohm's Law
2. Resistors in series and parallel
3. Multimeter demo, build an LED circuit on a breadboard
4. Kirchoff's Voltage Law, simple analysis with Excel
5. Begin Arduino programming, Kirchoff's Current Law, binary numbers
6. Arduino programming for controlling a small DC motor, structured Excel
7. Plotting in Excel, introduction to servo motors
8. Plotting in Excel, Arduino servo control, 2D drawing in Solidworks
9. Soldering the DC motor. Finish Solidworks drawing
10. Midterm
11. Desktop fan wrap-up. What is design?
12. Least squares linear regression
13. Desktop fan presentations and R^2 coefficient for linear regression
14. Introduction to pump fabrication
15. Pump fabrication, linear least squares fitting to exponential and power-law functions
16. Pump assembly and testing
17. Pump testing
18. Pump presentations
19. Course wrap-up, review for final exam.

Computer and E-mail Accounts

If you haven't done so already, please go to the CADLab 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.