Course name	GEOS 440: Fundamentals of Environmental Science Instrumentation
Semester	Fall, 2017
Instructor	Dr. Shane D. Mayor
Meetings	Fridays, 2:00 – 5:00 PM. Lecture in PHSC 130. Lab in PHSC 225. PHSC 208 is also available.
Office hours	Wednesdays from 2:00 – 5:00 PM (Please e-mail me to let me know you are coming. If not in office, check PHSC 128 or PHSC 217.)
Office	Physical Science Building (PHSC), room 117
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Class webpage	http://physics.csuchico.edu/~sdmayor/teaching/GEOS440_F17/index.html
Prerequisites	GEOS 250 and PHYS 202B or PHYS 204B or PHYS 204C.
Required Book	Harrison, R. G., *Meteorological Measurements and Instrumentation*, ©2015, Wiley Blackwell, 257 pages. (Available on-line as free e-book through University Library.)
Required Hardware	Arduino data acquisition kit. Available for purchase at the first meeting. (Access to a PC or a Mac with USB port and network connectivity is also required.)
Recommended Books	Banzi, M. and M. Shiloh, ©2015: Make: Getting Started With Arduino, 3rd Edition, 246 pages. Monk, S. ©2016: Programming Arduino: Getting Started with Sketches, 2nd Edition. 176 pages.
Related Books	Brock, F. V. and S. J. Richardson, ©2001: *Meteorological Measurement Systems*, Oxford University Press, 290 pages. DeFelice, T. P., ©1998: *An Introduction to Meteorological Instrumentation and Measurement*, Prentice Hall, 229 pages. Fritschen, L. J. and L. W. Gay, ©1979: *Environmental Instrumentation*, Springer-Verlag, 216 pages.
Course Overview	Instruments are critical to making *quantitative* observations, and observations are critical to the scientific method. The subject of environmental instrumentation is vast and constantly changing as new technologies emerge. In this course, through a combination of lectures and hands-on projects, you will be (1) introduced to the process of assembling and characterizing an electronic instrument of your own, (2) forming a hypothesis and testing it by collecting data, and (3) writing reports and giving presentations on your results.

Attendance	Attendance is mandatory, a record of attendance will be made, and it will be a factor in the determination of course grades. Attendance in this course is more important than usual due to the fewer number of meeting times (once per week instead of two or three times per week). Valid excuses for absence include illness, accident, or death in the family. Official documentation, such as a note from a physician, is required.
Course Grade	Course grades will *tentatively* be based upon attendance, performance on the 4 projects described below, and perhaps a few homeworks, quizzes, and exams. Attendance and quizzes each may be a significant part of your grade (possibly up to 25%). Letter grades will be assigned based on the total of number of points accumulated. For example, ≥97% A+, 93% A, 90% A-, 87% B+, 83% B, 80% B-, 77% C+, 73% C, 70% C-, 67% D+, 63% D, <63% F. The instructor reserves the right to adjust the number of factors, the weighting, the total number of points, and the grade scale as he deems necessary.
Tentative Projects	Subject to change. Details on each forthcoming.
Project 1	Assemble a data acquisition system and connect and characterize a temperature sensor. This requires purchasing an Arduino data acquisition kit which will be made available on the first day of class. The project will involve soldering components which you can do during lab time with university tools and uploading programs from a PC or Mac. You will also connect a temperature sensor, collect some data, calculate some statistics, and write a lab report. Due date: 15 September 2017.
Project 2	Select a different sensor of interest (not the temperature sensor(s) with your kit), purchase or borrow one (some may be available from the GEOS Department), connect it to your Arduino data acquisition system, and program it to acquire data. Develop tests to characterize your chosen sensor's performance. You may not share the same sensor with other students. You must obtain or write Arduino code to sample the signal from your sensor and write the data to the memory card of your data acquisition system. You must write a lab report and give a brief presentation on your instrument to the class. Due date: 6 October 2017.
Project 3	Form a hypothesis about how a physical system in your area of interest behaves. Design an experiment and use your instrument (resulting from Projects 1 and 2) to collect data in order to test your hypothesis. (Note: You should make, purchase, or borrow a *weatherproof enclosure* for your data acquisition system to prevent damage to it if it must be left outdoors.) You must use a computer and software of your choice to read and plot the data from your instrument. Write a lab report and give a brief presentation on your experiment and results to the class. Due date: 17 November 2017.
Project 4	Select an established, perhaps more complex, instrument or instrument system (a system may have multiple sensors), that is of particular interest to you and used in environmental science. Learn about it on-line and through books or peer-reviewed journal articles. Prepare and give a brief oral presentation. Your presentation should include the physical (or chemical or biological) properties that the instrument measures; the performance of the instrument; and the applications of the instrument with particular attention to how the data have made a unique contribution to science. Due date: 8 December 2017.

Lab notebooks — You are required to purchase and take notes in your lab notebook. You are required to bring your lab notebooks to every lab. Lack of a lab notebook during lab will result in a lab notebook grade penalty. You must keep notes in one notebook. Multiple notebooks are not permitted. Hand the single notebook in at the end of the semester for a to-be-determined number of points as part of your final course grade. Spiral bound, graph-ruled, notebooks are available at the University Bookstore. Scores will be based upon how thorough and neat your notes are.

Time — In addition to the Friday afternoon meetings, you are required to spend a minimum of two additional hours per week working on your projects. This can be done at a time and location of your choosing. Consider: additional time will be required to learn about your sensors, experiment with them, troubleshoot problems, collect and analyze data, write reports, and prepare presentations.

Drop & Add — You may drop (or add) without obtaining permission until Friday, September 1. From September 2 to September 15, you must obtain permission from the instructor to drop. After Friday, September 15, you will need a serious and compelling reason to drop and your request must be approved by the Department Chair and the College Dean. Students adding after classes have started are responsible for obtaining a syllabus and lecture notes and making up any missed quizzes and assignments.

Etiquette — **Please do not eat in lecture or lab.** The noises and smells may be a distraction for your peers. Plan your day so that you have adequate nourishment before class. Please silence mobile phones and put them away. Texting and surfing the web while in class is rude. Please do not hold conversations with neighbors during lecture. Also, please be mindful of the volume of your voices when in lab: voices carry and professionalism is important.

Please come to class or lab on time. Walking in several minutes late is a distraction for everyone. We understand if it happens due to unforseen events or higher priority appointments, but chronic lateness projects a lack of maturity and respect, and it will be taken into account for your course grade.

Extra credit — Use LaTeX to type any written report associated with the above projects and receive 10 extra points per report.

Fall 2017 GEOS 440 meeting dates, significant events, and *tentative* schedule.

1	Fri.	25	Aug.	Review syllabus and begin.
2	Fri.	1	Sept.	**Last day to add or drop without permission from instructor.**
3	Fri.	8	Sept.	
4	Fri.	15	Sept.	Project 1 due. **Last day to add or drop.**
5	Fri.	22	Sept.	
6	Fri.	29	Sept.	
7	Fri.	6	Oct.	Project 2 due.
8	Fri.	13	Oct.	
9	Fri.	20	Oct.	
10	Fri.	27	Oct.	
11	Fri.	3	Nov.	
	Fri.	10	Nov.	Veterans Day. Campus closed.
12	Fri.	17	Nov.	Project 3 due.
	Fri.	24	Nov.	Thanksgiving break. Campus closed.
13	Fri.	1	Dec.	
14	Fri.	8	Dec.	Project 4 due.
15	Fri.	15	Dec.	Final Exams Week

Note: This is a *tentative* schedule and the exact dates and agenda items are subject to change. Students are responsible for coming to class to learn about any changes in the schedule, course content, and grading policy. Instructor reserves the right to modify this syllabus at any time.