ECE 510 Instrumentation and Sensing Systems
Course Description: Introduction to high frequency measurements, wireless instrumentation and remote measurement system hardware at the graduate level. Topics include: The Network Analyzer, Interference and noise; wireless sensor link budgets; position-velocity sensing using modulated scatterers; mechanical and electrical fabrication techniques using the Prototyping Lab. Project focus for Fall 2013 is low-data-rate off-grid wireless sensing.

Schedule--Fall Quarter 2013
Monday and Wednesday 6:40 - 8:30 p.m. on campus

Course Outcomes  Students will be able to:

Understand the analog/RF front-end block diagram and mathematics for systems that collect and process complex envelope data, such as Vector Network Analyzers and remote data collection.

Design the hardware analog/RF interface between microcontrollers and the physical world.

Design, build, measure and deploy a simple RF link from a remote sensor to a base station receiver.

Design, build, measure and deploy a modulated scatterer (RFID type) sensor for precision local position and velocity sensing.

Design, build, and measure sensor hardware using basic electronic and mechanical fabrication tools in the Prototyping Laboratory.

Demonstrate familiarity with power budgets, environmental constraints, and mission length for remote platforms such as Sonobouy, AUV, UAV, USV and MicroSatellites.

Comfortably report results of graduate level personal hardware projects in technical presentation and written form.
Supplementary Texts:
2013 Handbook for Radio Communications, ARRL, chapters 8, 13, 20
Op-Amp Applications Handbook, Jung editor, Newnes, chapters 2, 3, 4, 5
Microwave Engineering, David Pozar, Chapter 4, section 4.3

Problem sets and study guides:
Each topic will include a weekly problem set and study guide, available on-line at web.cecs.pdx.edu/~campbell under ECE510 IS Study guides. Each week’s study guide is posted Monday, and due in class the following Monday. Collaboration on study guide work is expected and encouraged.

One In-class midterm, Final presentation
In-class exam questions are taken from the study guides. Exam is closed-book without notes, calculators, or assistance. Final presentation includes short technical presentation and demonstration of project hardware. Exam, project contributions, class participation, and completion of successful project work on schedule all carry equal weight in the final grade

Classroom environment
Each class will include a lecture and active discussion. After the mid-term exam classes will include live student project demonstrations. Class participation and attendance are necessary and expected.

Projects and Demonstrations
The emphasis is on making a connection between fundamentals and working instrumentation and measurement hardware. Students select a full-quarter hardware project from a suggested list. Project sketches evolve in the early weeks of the quarter, and weekly study guides are fine tuned to provide background to the full class. The lab component of the course is exploratory and informal. Projects are student-owned, and expected to continue beyond the context of the class.

Prerequisite
ECE510 Instrumentation and Sensing I is intended as a bridge course, for students entering or leaving graduate school, and for seniors and industry professionals contemplating graduate work at Portland State University or desiring to make the connection between graduate level math, science and engineering courses and practical working hardware. Adequate preparation includes a BS in engineering, math or science and a willingness to work independently and in groups on small, advanced projects.