Description:
Fundamental course on sensors, instruments, and real-time systems to monitor environmental systems. Applications to atmospheric and radiation, weather, air quality, hydrological, water quality, terrestrial ecosystems, and aquatic ecosystems. Sensors: technology, operation principles, calibration, and maintenance. Data acquisition systems and telemetry: data loggers, sensor networks, wireless communications, and networks. Informatics: database, metadata, standards, data sharing, and preservation. Environmental observatories. Credit hours: 3 hrs.

Prerequisites:
Consent of the department.

Instructor
Miguel F. Acevedo, Regents Professor Electrical Engineering (EE), and Institute of Applied Sciences (IAS). Office Discovery Park B-260, Phone 940-891-6701, acevedo@unt.edu,

Office hours:
Tuesday-Thursday 8-10 AM, or by appointment.

Format:
- Lectures and computer labs. Software: most used R.
- Homework assignments. Note: Assignments for 5340 are longer and/or more difficult than for 4340.
- Online resources: Blackboard learn https://learn.unt.edu

Grade:
- 45% average graded assignments.
- 50% two exams.
- Attendance 5%.

Exams
- Exam 1 (Midterm) Thursday March 10
- Exam 2 (non-comprehensive Final) Designated final day: Exam 2 (Final) according to UNT schedule May 12, 8-10 AM http://registrar.unt.edu/exams/final-exam-schedule

Textbooks Required:
Class Evaluation by Students
The SPOT (Student Perceptions of Teaching) evaluation is a requirement for all organized classes at UNT and is available for your input at the end of the semester.

Topics (approximately by week):
1. Principles of Monitoring
   a. Why monitoring? short-term vs long-term
   b. Earth systems, ecosystems, environmental systems
   c. Applications: regulatory, decision making, environmental observatories, education and public outreach, analysis and modeling
2. Sensors and transducers
   a. Principles of circuits and electronics
   b. Principles of sensors
   c. Examples
3. Sensors and transducers
   a. Bridge circuits
   b. Sensor technology, operation principles
   c. Calibration, and maintenance
4. Signal Conditioning and A/D converters
   a. Amplifiers
   b. Noise, isolation
   c. A/D converters
5. Data acquisition systems
   a. Data loggers
   b. Real-time clock
   c. Communication: serial, standards
6. Single board computers and microcontrollers
   a. Microcontrollers
   b. SBC
   c. Examples
7. Wireless technology and telemetry
   a. Radio waves, transmission, reception, antennas
   b. WiFi and telemetry
8. Wireless sensor networks
   a. Examples
   b. Protocols
9. Power sources and storage
   a. Solar cells, optimizing power
   b. Batteries, charging
   c. Energy harvesting
10. Informatics
    a. Database design and implementation
b. Metadata, standards, data interoperability
   c. Data preservation, web interface, content management

11. Atmospheric monitoring
   a. Solar radiation, Electromagnetic Spectrum
   b. Absorption, reflection, scattering
   c. UV and ozone
   d. Fiber Optics, spectrometers
   e. Air quality, aerosols and particulate matter, Gases, Ozone, NO2, CO2
   f. Weather, Temperature, Rain, Relative Humidity, Wind velocity and direction

12. Hydrology, hydrodynamics, water quality
   a. Water velocity, water flow, discharge
   b. Water level and depth
   c. Water quality and aquatic ecosystems
   d. DO, pH, Chlorophyll, conductivity, turbidity, fluorometers
   e. Productivity and respiration
   f. Biomonitoring, Ecotoxicology, organism response to stress

13. Terrestrial Ecosystems
   a. Soil moisture
   b. Evapotranspiration
   c. Productivity
   d. Gas exchange
   e. Tree growth, dendrometers
   f. Leaf area

14. Wildlife monitoring
   a. Radio tags
   b. Acoustic tags
   c. GPS trackers
   d. Camera and video
Policies

Grades: All grades for the course will be final. No extra credit assignments or work will be considered after the final grade has been recorded.

Accommodations: The EE Department in cooperation with the Office of Disability Accommodation complies with the Americans with Disabilities Act in making reasonable accommodations for qualified students with disabilities. Please present your written accommodation request before the 12th class day.

Academic Dishonesty: Students caught cheating, plagiarizing, or any other academic dishonesty will be subject to penalty according to the new Policy on Students Standards on Academic Integrity. See full policy at http://www.unt.edu/policy/UNT_Policy/volume3/18_1_16.pdf

According to this policy the categories of academic dishonesty are:

A. Cheating. The use of unauthorized assistance in an academic exercise, including but not limited to:
   a. use of any unauthorized assistance to take exams, tests, quizzes or other assessments;
   b. dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems or carrying out other assignments;
   c. acquisition, without permission, of tests, notes or other academic materials belonging to a faculty or staff member of the University;
   d. dual submission of a paper or project, or re-submission of a paper or project to a different class without express permission from the instructor;
   e. any other act designed to give a student an unfair advantage on an academic assignment.

B. Plagiarism. Use of another’s thoughts or words without proper attribution in any academic exercise, regardless of the student’s intent, including but not limited to:
   a. the knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgement or citation.
   b. the knowing or negligent unacknowledged use of materials prepared by another person or by an agency engaged in selling term papers or other academic materials.

C. Forgery. Altering a score, grade or official academic university record or forging the signature of an instructor or other student.

D. Fabrication. Falsifying or inventing any information, data or research as part of an academic exercise.

E. Facilitating Academic Dishonesty. Helping or assisting another in the commission of academic dishonesty.

F. Sabotage. Acting to prevent others from completing their work or willfully disrupting the academic work of others.