Aircraft Measurement Systems (AtSc 594-02)
Course Syllabus - Fall 2022

Course Information

AtSc 594-02: Aircraft Measurement Systems (3 credits)
Pre-requisites: Graduate Status or permission.
Class Meeting Time: Tuesday/Thursday 1:00 – 2:15 p.m. Central United States Time.
Class Meeting Location: Clifford Hall 423

Contact Information

Instructor: David Delene
Office: Clifford Hall 420
Office Hours: Tuesday/Thursday 2:15-3:00 a.m. or by Arrangement
Web Page: http://aerosol.atmos.und.edu
Email: **delene@aero.und.edu**
Skype User Name: david.delene
Phone Number: 507-533-5363
Zoom Meeting ID: 948 8934 2367

Policies and Procedures

Attendance

Attendance is very important for this class; however, attendance is not part of a student's grade. Please try hard to make it to class on time; however, if this is not possible, please come in late if necessary without disturbing the class. Students are responsible for finding out what material they missed if they do not attend class, which includes class handouts and assignments.

Disability and Access

If you have emergency medical information to share with me, if you need special arrangements in case the building must be evacuated, or if you need accommodations in this course because of a disability, please make an appointment with me using the contact information provided above. If you plan to request disability accommodations, you need to register with the Disability Support Services (DSS) office (190 McCannel Hall, 777-3425).

Missed Exams or Assignments

Students need to arrange with the instructor beforehand for any Exam or Assignment they will miss. Students are responsible to find out about assignments and upcoming exams if they cannot attend a class.

Scholastic Dishonesty

Please refer to the code of student life for information on cheating and plagiarism. Students are to complete assignments and exams individually. Students are encouraged to work together to learn the material but must complete assigned work individually. Turning in identical assignments will result in zeros for both assignments and may result in failure of the course.

Grading

There will be course exam(s). Individually written papers will be required for laboratory project. Quizzes will be given frequently to check that students are doing assigned tasks.

Course grading scale is as follows: 90% A, 80% B, 70% C, 60% D. Grades are based on 30 % exam(s), 50 % papers, 20 % quizzes.

Class Format

Lectures will cover a variety of topics related to the cloud physics instrument deployed for the 2023 IMPACTS field project. Topics include instrument design, selection, instrument calibration, uncertainty in measurements, system integration, data logging, quality control, and quality assurance. Many of the classroom lectures describe a particular instrument that is later be used to obtain data for analysis. A large portion of the course will pertain to working with instruments and class time is used to conducted laboratory exercises and obtain data. Labs will include calibration and testing of instrumentation, deployment of instruments, data acquisition, and data analysis techniques.

Aerospace Computer Accounts

Data is distributed using the Aircraft University of North Dakota server (aircraft.atmos.und.edu), which can be access via ssh using port 22000. Students need an account on the Aircraft server. Students need to know and adhere to the North Dakota State Board of Higher Education Policy on Computing Facilities. Failure to comply with the policy on computing facilities may result in failure of the course.

Reference Material

No text book is required for the class. Material from these books will generally be provided as need depending what laboratory experience we are working on. The following books may be useful.

Airborne Measurements for Environmental Research: Methods and Instruments, Manfred Wendisch and Jean-Louis Brenguier.
Meteorological Measurement Systems, Brock and Richardson.
Measurement Systems Application and Design, Ernest Doebelin, 5th Edition.
Meteorological Instrumentation and Measurement, DeFelice
Instrumentation for Physical Environmental Measurements, Wang and Felton.
An Introduction to Error Analysis, Taylor, University Science Books

Course Objectives

To provide a broad overview of aircraft cloud physics measurement systems, along with an in-depth look at a few select systems. Topics to be covered including performance characteristics of sensors, calibration standards, measuring devices, coupling measurements to the atmospheric environment, meteorological measurement systems, digital data logging, data processing, data quality control, and data quality assurance. Students are encouraged to suggest topics of interest. I will try to incorporate student interest topics into the course as much as possible.

Tentative List of Labs

Forward Scattering Probes (CDP, FCDP)
Two-dimensional Image Probes (HVPS3 and 2D-S)

Course Topics (Not necessary in course order.)

1. Data Processing (Work Flows)
2. Writing Technical Papers (Tools and Methods)
3. Calibration
    a. Static

- **b.** Dynamic
- **c.** Drift
- **d.** Exposure

4. Uncertainty (error) in Measurements
    - **a.** Standard Error Definitions
    - **b.** Error Propagation
5. Instrumentation
    - **a.** Data Logging
    - **b.** Cloud Physics Measurements
        - i. 2-dimensional Cloud Imaging Probes
        - ii. Cloud Scattering Probes
    - **c.** State Variable Measurements
        - i. Pressure
        - ii. Temperature