ASEN 6011: Experimental Fluid Mechanics

University of Colorado Boulder

Fall Semester 2020

Syllabus

Time: Tue. & Thurs. 02:50 PM - 04:05 PM

Physical Classroom: AERO 232

Virtual Classroom/Office:

Instructor: Assistant Professor John Farnsworth
Physical Office: AERO 365
Office Phone: (303)735-7287
Email: john.farnsworth@colorado.edu
Office Hours: Mon. 11:00 AM - 12:00 PM

Website: Canvas (https://canvas.colorado.edu)

Slack Workspace: To help better facilitate online communication this semester we will also be using the following Slack Workspace: Please note that you are not required to use this and all course wide notifications will still be sent out also via notifications through the course webpage, but we believe this application will help improve communication and collaboration within the course.

Objective: To establish a fundamental understanding of the theory and practice of performing experimental measurements in fluid mechanics.

Description: This course presents an intermediate level introduction into the theory and practice of performing experimental measurements in fluid mechanics. The fundamental principles and definitions associated with instrumentation, measurement procedures, data analysis, and uncertainty quantification will be discussed. A specific focus will be placed on the application of a variety of measurement techniques in low-speed aerodynamic environments. A selection of measurement techniques will be extensively studied and applied including: classical pressure and temperature measurements, thermal (hot-wire) anemometry, laser doppler anemometry, particle image velocimetry, surface and field flow visualization techniques, schlieren and shadowgraph photography techniques.

Prerequisites: Undergraduate level courses dedicated to the fundamentals of fluid mechanics, thermodynamics, and aerodynamics are recommended for this course. A basic background in optics, simple electronics, system dynamics, and signal processing will also be beneficial.

Required Text:

S. Tavoularis, *Measurements in Fluid Mechanics*. Cambridge University Press, 1st ed., 2005.

Note: There is no o cial online access to this text through the CU Library.

Supplemental References:

Note: The CU library provides full online access to many of these texts. The links posted below should take you to the library search page from which you can access the texts. To access you may have to be on the campus network, logged into the campus VPN from o -campus, or may be asked to log in with your campus credentials to access the text.

1. C. Tropea, A. Yarin, J.F. Foss, *Springer Handbook of Experimental Fluid Mechanics*. Springer, 1st ed., 2007. CU Library Online Access
2. R. J. Goldstein, *Fluid Mechanics Measurements*. Taylor & Francis, 2nd ed., 1996. CU Library Online Access
3. E. Rathakrishnan, *Instrumentation, Measurements, and Experiments in Fluids*. CRC Press, 1st ed., 2007. CU Library Online Access
4. H. W. Coleman and W. G. Steele, *Experimentation, Validation, and Uncertainty Analysis for Engineers*. Wiley, 3rd ed., 2009. CU Library Online Access
5. J. R. Taylor, *An Introduction to Error Analysis*. University Science Books, 2nd ed., 1997. CU Library Online Access
6. J. B. Barlow, W. H. Rae, A. Pope, *Low-Speed Wind Tunnel Testing*. Wiley, 3rd ed. 1999.
7. M. Ra el, C. Willert, S. Wereley, J. Kompenhans, *Particle Image Velocimetry*. Springer, 2nd ed., 2007. CU Library Online Access
8. R. J. Adrian and J. Westerweel, *Particle Image Velocimetry*. Cambridge University Press, 1st ed., 2010.
9. G. S. Settles, *Schlieren and Shadowgraph Techniques*. Springer, 1st. ed., 2001. CU Library Online Access

Grading: The following presents the planned grading structure for the course. Be aware, that this is subject to change, however the class will be thoroughly noti ed and polled for agreement.

60% Homework Assignments (approximately 6 during rst half of semester)
40% Lab Assignments(approximately 4 during second half of semester)
-Grades are posted to the class website (Canvas).

Class Format: The class meets in-person twice a week for an hour and fteen minutes of formal lecture and discussion. If students are unable to participate in-person, students are encouraged to participate in lectures virtually in a synchronous format using the Zoom web-link above. All lectures will be be recorded and posted on the course website for asynchronous viewing after the scheduled lecture period, and all students actively enrolled in the course will have access to the lecture videos. All o ce hours and other one-on-one meetings associated with this course will take place in a virtual format using the Zoom web-link provided above, same as that used for lectures.

Select class meetings will be held in the Experimental Aerodynamics Laboratory which is

part of the Sustainability Energy and Environment Complex (SEEC) on the CU Boulder East Campus. During these class periods hands-on experimental laboratory experiments will be conducted.

Homework Assignments: Approximately six sets of homework problems will be assigned during the first half of the semester so that students can implement and practice the theory and concepts discussed in class through traditional engineering problem solving. Students will

clean local work area,

practice hand hygiene,

follow public health orders, and

if sick and you live o campus, do not come onto campus (unless instructed by a CU Healthcare professional), or if you live on-campus, please alert CU Boulder Medical Services.

Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Con ict Resolution. For more information, see the policies on COVID-19 Health and Safety and classroom behavior and the Student Code of Conduct.
If you require accommodation because a disability preve-28(ecause)-403(a)-/28(-358(faibl]TJ 0 -13.549 Td

clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of