THE UNIVERSITY OF COLORADO BOULDER

ASEN 5051: Fluid Mechanics
Fall 2018

SYLLABUS

Instructor: Assistant Professor John Evans
Office: ECAE 159
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Office Hours: Tuesday/Thursday, 2:00 pm – 3:30 pm

Time: Tuesday/Thursday, 12:30 pm – 1:45 pm

Location: ECCR 105

Course Assistant: Anubhav Gupta
Office: Graduate Lounge
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Office Hours: Monday, 4:00 pm – 5:30 pm
Wednesday, 1:00 pm – 2:30 pm

Web Page: Desire2Learn (learn.colorado.edu)

Course Objective:

To establish a fundamental understanding of fluid mechanics with a specific emphasis on incompressible flows.

Catalog Description:

A rigorous introduction to the fundamentals of fluid mechanics. The course provides a solid foundation for students intending to study fluids at the advanced level but is sufficiently broad that it serves as a valuable survey for many other students. Topics: Cartesian tensors, kinematics of fluid flows, conservation laws, vorticity dynamics, theory and application of irrotational flows, topics in geophysical fluid dynamics, dynamic similarity and nondimensional parameters, viscous flows, and boundary layers. Intended for students in all engineering majors.

Prerequisites:

This class requires undergraduate courses in fluid mechanics, thermodynamics, and ordinary and partial differential equations. It attacks the subject at a graduate mathematics level with extensive use of index notation, vector calculus, and tensor analysis. Students will find the course material much easier to digest by reviewing these topics before the start of class as only a rapid review of the background material will be given.

Required Textbook:

Fluid Mechanics, Kundu, Cohen, and Dowling, Academic Press, Sixth Edition, 2016.

Reference and Supplemental Textbooks:

A First Course in Continuum Mechanics, Fung, Prentice Hall, Third Edition, 1993.
Fluid Mechanics, Granger, Dover, 1995.
Vectors, Tensors and the Basic Equations of Fluid Mechanics, Aris, Dover, 1989.
Incompressible Flow, Panton, Wiley, Fourth Edition, 2013.

Topics:

1. Basic Fluid Concepts
2. Scalars, Vectors, and Tensors
3. Basic Kinematic Concepts
4. Conservation Laws
5. Potential Flows
6. Vorticity Dynamics
7. Waves in Fluids
8. Laminar Flows
9. Boundary Layers
10. Stability and Transition to Turbulence
11. Turbulent Flows

Class Format:

The class meets twice a week for an hour and fifteen minutes of formal lecture and discussion. Each lecture will be recorded and distributed using Mediasite. To learn more, please visit: https://oit.colorado.edu/services/teaching-learning-spaces/distance-learning-studios/faq

Grading:

20% Weekly Homework Assignments
20% Mini-Projects
25% Midterm Exam
35% Final Exam

Grades will be posted to the class website on Desire2Learn.

Reading Assignments:

Reading assignments are assigned frequently through the course website and are to be completed before lecture. The lecture should help to clarify and supplement what students have read. The instructor will post his notes to the course website after lecture. If a student has any questions on

the reading material, he or she should contact the instructor by e-mail who will address the question during lecture.

Homework Policy:

There will be weekly homework assignments throughout the semester (except for the weeks of the midterm and final examinations), and students will have one week to complete each assignment. Students should make an effort to turn in assignments that are organized, professional looking, and legible. Students must staple their work (no paperclips or dog-ears). Very messy work will be returned to a student ungraded and a score of zero will be recorded. Final answers should be indicated with an arrow, underline, or box. Multiple answers (when only one is required) will be counted as incorrect.

Homework is due at the start of class on the due date. Late assignments will not be accepted, though there will be a five-minute grace period. If an on-campus student will be unable to attend class, he or she may submit his or her homework early by slipping it under the instructor's door. ***Distance students should submit their assignment directly to the course assistant by e-mail.***

Collaboration is permitted on homework. This means students may discuss the means and methods for solving problems and even compare answers, but students are not free to copy someone's assignment. The work that a student turns in must be his or her own – copying is not allowed for any assignment and will not be tolerated. Students who are caught copying (or providing his or her assignment to another) will receive an "F" for the course and reported to the Dean's office for further punitive action.

Each homework assignment will be given equal weighting in a student's final grade. Only one to two problems will be graded for each assignment. Students will not be informed which problems will be graded before the assignment is due.

Mini-Projects:

Two mini-projects will be assigned during the semester. The first mini-project will involve the modeling of flow over a class of airfoils using conformal mapping and potential flow theory, and the second mini-project will involve the simulation of interacting vortex rings. Students may pair up in teams for both mini-projects, and they will need to employ the numerical computing environment MATLAB. Each mini-project is worth 10% of a student's total grade. It is anticipated that the first mini-project will be assigned in early October and the second mini-project will be assigned in early November. Students will have approximately one month to complete each mini-project, and they will be required to upload both their code and a write-up to a Dropbox located on the course website.

Examination Policy:

The midterm and final examinations will cover all material in the course including lecture, discussions, and homework. The midterm examination will be held in October. The final examination will be held on December 19 at 4:30 pm and will be cumulative.

Collaboration on the midterm examination will not be tolerated. Students who are caught in these activities will receive an "F" for the course and reported to the Dean's office for further punitive action. Students are free to ask the instructor any clarification questions.

Additional Information for Distance Students:

Distance students will be able to attend each lecture synchronously using the Zoom conferencing tool. The Zoom conference tool is currently not accessible to users using assistive technology, so if you use assistive technology to access the course material, please contact the instructor immediately to discuss.

To join each lecture synchronously, please refer to the following instructions:

- Meeting ID: 347-488-618
- Connection options:
  - Join via web browser: https://cuboulder.zoom.us/j/347488618
  - Join via Zoom app (using meeting ID)
  - Join via iPhone one-tap: US: +16699006833,,347488618# or +16465588656,,347488618#
  - Join via telephone: US: +1-669-900-6833 or +1-646-558-8656
    (Note: for higher quality, dial a number based on your current location)

If you need help with getting Zoom up and running, please visit the following link:
http://www.colorado.edu/oit/services/conferencing-services/web-conferencing-zoom

Accommodation for Disabilities:

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your instructor in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

Religious Holidays:

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, you must let the instructor know of any such conflicts within the first two weeks of the semester so that he can work with you to make arrangements. See campus policy regarding religious observances for full details.

Classroom and On-Campus Behavior:

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with

race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. The instructor will gladly honor your request to address you by an alternate name or gender pronoun. Please advise the instructor of this preference early in the semester so that the instructor may make appropriate changes to his records. For more information, see the policies on classroom behavior and the Student Code of Conduct.

Discrimination and Harassment:

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (including sexual assault, exploitation, harassment, dating or domestic violence, and stalking), discrimination, and harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

Honor Code:

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, 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 academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

Prepared by: John Evans Date: August 20, 2018