

**ME 8010 – Foundations of Fluid Mechanics
Fall 2018**

Class Hours: 0530 – 0800 PM Thursday (11 Rhodes and 104 Zucker)
Instructor: R. S. Figliola, PhD, PE
Alumni Distinguished Professor of Mechanical Engineering and Bioengineering
Office: 247 Fluor-Daniel Bldg (main campus) and 312 Zucker Center (Charleston)
Communication: fgliola@clemson.edu
Office Hours: for administrative/performance questions only, immediately after class; or by appointment
Course Assistant: Matthew Quinones <mquinon@clemson.edu>, Graduate student in Mechanical Engineering;
Assistant Hours: Use email to communicate and setup times for course materials and problem solving assistance

Course Information

Description: Derivations of basic equations for multi-dimensional flow fields; analytical techniques for solving laminar viscous and inviscid flows. 3 credit hours.

Textbook: *Fundamental Mechanics of Fluids – 4th ed*, I.G. Currie, Taylor-Francis.
PLUS: any undergraduate level fluid mechanics text book (see references) – this will be used in early part of course.

References: *Fluid mechanics*, Kundu, Cohen, Dowling, Academic press (*previous text*)
Fundamentals of Fluid Mechanics – 7th, Munson et al., Wiley (good undergrad text)
Boundary-Layer Theory – 8th ed., H. Schlichting, K. Gersten, E. Krause, H. Oertel,

Prerequisites: Graduate student standing in engineering, physical science, or math.

Course Objectives:

Develop the capability to describe, formulate, assign boundary/initial conditions and appropriately apply techniques to analyze and solve fluid flow problems. The course builds on undergraduate basics.

Topical Outline (nominal coverage):

1. Basic Conservation Laws of Motion and Navier Stokes Formulation (8)
2. Flow Kinematics (2)
3. Potential Flow Basics (5)
4. Exact Solutions of Navier-Stokes Equations (6)
5. Boundary Layer Flows (3)
6. Turbulent Reynolds-Averaged Navier Stokes Formulation (2)
7. Special Topics (4)
7. Tests and Review (2)

Evaluation Methods: (tentative dates)

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| 1. Quizzes (9/6, 9/27,10/18, 11/15) | 70% (each will be 30 minutes duration) |
| 2. Final Exam (as scheduled) | 30% (Exam will be 2 hours duration) |

Homework will be assigned so that you can master the material. You may be asked to discuss or present your homework solution to the class. It will not be collected or graded and solutions will be posted. Review sessions with the teaching assistant will be provided periodically and you should attend.

Other Details:

Course Goals

The purpose of ME 8010 is to establish the foundations for fluid mechanics activity. Much of the course deals with learning the language of fluid mechanics, not solving undergraduate engineering problems. Hence, the course tends to be based on theory but with application to idealized problems.

Credit Policy

All work submitted for credit must be presented in a neat manner reflecting a professional attitude. The work presented must represent your individual effort. Please read **Academic Integrity** below.

Academic Integrity

The Honor Code is in effect for this course. All students, faculty and administrators at Clemson University are expected to abide by ethical standards of conduct. Copying homework, using unauthorized materials on tests, stealing or sharing information on tests and homework, failing to cite the work of others on your submitted work are all examples of cheating – a violation of the Honor Code. Please read the Honor Code and understand how it applies to you (http://www.ces.clemson.edu/main/students/undergrad/honor_code.htm). Understand this policy and what it intends. Questions or concerns? Ask the instructor. A violation will result in a minimum of an 'F' in this course.

Attendance

You are expected to attend lectures and participate in discussions. Two or more absences without permission will result in your name being dropped from the rolls without further notice.

Make-up Policy

To be fair to all students, only in the event of an official excused absence (documentation required) will a make-up exam or late work submissions be allowed. The Department phone number (656-1500) is published and has voice mail for such emergency messages. When a make-up exam is granted, I will use the average of your other tests as a surrogate score. If a second quiz is missed with official absence, I may decide the makeup to be oral (including Skype video) or written in format. A missed exam will be scored as a zero in the class role unless a make-up is approved and executed. Personal events, conferences, and job interviews are NOT official excused absences.

Ethics

Engineers are professionals and are expected to act in an ethical manner. I provide the pledge below made by all professional engineers. As students of engineering, please reflect on it and adopt it to your University training:

Engineers' Creed

As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare. I pledge:

To give the utmost of performance; To participate in none but honest enterprise; To live and work according to the laws of man and the highest standards of professional conduct; To place service

before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations. In humility and with need for Divine Guidance, I make this pledge. *Adopted by National Society of Professional Engineers*

Know Your Instructor: *Richard Figliola, PhD, PE*

I have been on the faculty at Clemson University since 1980 and have served the department in various capacities from assistant professor through a sustained period as its department head. I have taught this course many times and so I know what to expect in terms of class performance. My goal is to make fluid mechanics an interesting study for you.

Academically, I have earned a BS in Aerospace Engineering, an MS in Mechanical Engineering, and a PhD in Fluid Mechanics. Professionally, I have also held positions at Pratt and Whitney, as a jet engine test engineer, and at the von Karman Institute for Fluid Dynamics, as a NATO Fellow.

I am an active researcher in the areas of aerodynamics and bio-fluids modeling, which all tie back to my interest in fluid mechanics. I am primarily an experimentalist and modeler. I am a Life Fellow of ASME and am quite active in ASME professional activities, including current assignments on PTC 19.1 – Test Uncertainty.

As a licensed professional engineer and owner of a small consulting business, I provide expertise on flow and energy applications to many companies. I am also a consultant to the Air Force on the concept of hypersonic aerospace vehicle conceptual design. Personally, I have a strong interest in aviation and own and operate my own single engine aircraft and I am a dedicated, although mediocre (9 handicap), golfer.