

# USC Viterbi School of Engineering

## AME 309 Dynamics of Fluids

Units: 4

Term: Spring 2015    Jan 11<sup>th</sup> – Apr 29<sup>th</sup>

**Location**            Lecture    MW    10 – 11:50 am    WPH B27  
See course Blackboard page

**Instructor**            Charles Radovich  
**Office**                    RRB 202  
**Office Hours**            TTh 12 – 2 pm  
**Contact Info**            radovich@usc.edu    (213) 740.5359

**Teaching Assistant**    Shi Qui  
**Office**                    tbd  
**Office Hours**            M 8:30-11:30am, W 1-3 pm, F 9a-12pm  
**Contact Info**            shiq@usc.edu

### Course Description

An introduction to concepts and analysis methods of fluid mechanics. Topics covered include: hydrostatics; buoyancy; conservation of mass, momentum, and energy in integral and differential form; dimensional analysis; control volume analysis; open channel flows; boundary layers; lift and drag on objects; laminar and turbulent pipe flow; compressible flow; potential flow over bodies.

**Co-Requisite (s):**            MATH 245  
**Recommended Preparation:**    AME 201, AME 310

**Textbook**            Frank White, Fluid Mechanics, 7th Ed, McGraw-Hill, Inc. **(required)**

**Grading**            20% Homework | 20% Project | 40% Midterm Exams (2) | 20% Final Exam

### Discussion Board

This course will use Piazza for all class discussions. Refrain from emailing questions related to assignments, midterms, etc., and instead use Piazza. TA's, myself and even you can answer questions as they arise, thus providing an efficient means for communication. If you have issues accessing the Piazza, contact [team@piazza.com](mailto:team@piazza.com) directly.

**Exams**            There are two Midterms and one cumulative Final Exam. See the course schedule.

**Project**            AME 309 includes a design project where theory is put into practice. Previous semesters have designed, constructed and launched a soda bottle water rocket; here's a video from a previous launch: <http://vimeo.com/81151514>. A project of similar theme will be completed this semester as well.

**Software**            **Matlab:** student license available at <http://software.usc.edu/>  
**MS-Excel:** student license available at <https://itservices.usc.edu/officestudents/>  
These programs are also available in all USC computer labs.

**Schedule**            See next page.

Week	Topics	Reading
1	Characterizing a fluid and the state-of-stress in a fluid	Ch.1
2-3	Fluid statics: manometry, forces on submerged surfaces	Ch.2
4	Conservation of mass	Ch.3
5	Conservation of momentum	Ch.3
6-7	Conservation of energy	Ch.3
	Bernoulli's equation along a stream tube with and without losses	Ch.3
8	Concepts from dimensional analysis	Ch.5
<b>Midterm 1 (Wednesday, March 2<sup>nd</sup>)</b>		
9	Equations of motion in differential form	Ch.4
<b>Spring Break</b>		
10	Flow in pipes and ducts with losses	Ch.6
11	Boundary layer flows	Ch.7
12	Flow past bluff bodies	Ch.7
<b>Midterm 2 (Wednesday, April 6<sup>th</sup>)</b>		
13	Flow in open channels (friction, channel transitions, hydraulic jumps)	Ch.10
14-15	Compressible flow (subsonic & supersonic flow, shock waves)	Ch.9
<b>Final Exam (Monday, May 9<sup>th</sup> 8-10AM)</b>		

### Description and Assessment of Assignments

There will be two Midterm Exams held during the regular lecture time, and one Final Exam. All written exams will be closed book and closed notes unless noted otherwise. Homework sets will be assigned weekly. It is your responsibility to complete the problem set and to submit the assignment by hand before the due date.

Each assignment is due **before** class begins, or as specified in class announcements. Physical documents must be handed in; electronic submissions will not be accepted. **All assignments are due before the start of lecture. Late assignments will not be accepted. One microsecond (1  $\mu$ s) late is considered late and there are no exceptions.**

In order to receive credit for your work, all homework and exam problems must be presented in a clear, organized manner. Solutions must show evidence of work; "magic" answers will not be accepted. Partial credit may be given if the solution is presented in a logical fashion. There are office hours throughout the week to help you with the course material; this time is best utilized when students come prepared with an attempt at a solution, thus allowing us to help you through your thought process.

There are no make-up assignments or exams. The lowest homework grade will be dropped from your total score; use this to your advantage if you have an upcoming schedule conflict. Everything else will count towards the final grade. Absences for medical reasons must be justified with some verifiable evidence; first obtain doctor's note, then see me.

All homework and exams are to be completed as an individual. Failure to comply with this requirement will result in a failing grade for the course. All students should read and understand the Academic Conduct section below.

### Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <http://studentaffairs.usc.edu/scampus/>.

**All forms of academic dishonesty are unacceptable.** Example Violations and Sanctions are detailed below; view the complete list of sanctions at [https://studentaffairs.usc.edu/files/2015/09/appendix\\_a.pdf](https://studentaffairs.usc.edu/files/2015/09/appendix_a.pdf). See additional information on scientific misconduct at <http://policy.usc.edu/scientific-misconduct>.

Violation	Sanction
Copying answers from other students on any course work.	F for course
One person allowing another to cheat from his/her exam or assignment.	F for course for both persons
Possessing or using material during exam which is not expressly permitted by the instructor.	F for course
Continuing to write after exam has ended.	F for course
Taking exam from room.	F for course; possible suspension
Changing answers after exam has been returned.	F for course; possible suspension
Obtaining a copy of an exam or answer key prior to administration.	F for course; suspension or expulsion from the university
Plagiarism — Submitting other's work as one's own or giving an improper citation.	F for course
Unauthorized collaboration on an assignment.	F for the course for both students
Documentary falsification (e.g., petitions and supporting materials; medical documentation).	Suspension or expulsion from the university; F for course.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu> or to the *Department of Public Safety* <http://dps.usc.edu/contact/>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage <http://sarc.usc.edu> describes reporting options and other resources.

### Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/alj>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* <http://dsp.usc.edu/> [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.