AME457 - ENGINEERING FLUID DYNAMICS Fall 2018

Time: Th 6:40-9:20
Room: OHE100b

Instructor: Charles S. Campbell

Office: OHE400E
Phone: (213)740-0498
Fax: (213)740-8071
Email: campbell@usc.edu

Office Hours: Thursday 4-5

Text: There is no assigned text for this course. The main source is to be your classnotes.

There is a reference book in the bookstore but it is not required:

Fluid Mechanics by P. Kundu and I Cohen ISBN 978-0124059351

Other acceptable reference books are:

Basic Fluid Mechanics by D.C.Wilcox, ISBN 978-1-928729-46-4
Boundary Layer Theory by K. Gersten and H. Schlicting ISBN 978-3662529171
Viscous Fluid Flow by F. White, ISBN 978-0072402315
And there are probably many others.

Grading: Homework: 20%
Midterm: 35%
Final: 45%

Notes:

I will be often off campus on non-teaching days, but available by email.

Final Exam will be Thursday December 6, 7-9pm.

Homework is due at the start of class the week after the problem is assigned. No late homework is accepted.

For on campus students, cellphones, laptops, tablets and anything else electronic are to be turned off during class.

Course Outline

Introduction - The importance of viscosity in fluid dynamical problems of engineering interest

Transport Phenomena - derivation of viscosity coefficient from kinetic theory

Tensor analysis

Fluid Kinematics, vorticity etc.

Derivation of Governing Equations:

- Conservation of Mass - Stream Function etc.
- Conservation of Momentum - stress tensor
- Conservation of Angular Momentum
- Conservation of Energy

Exact Solutions

- Couette Flow, Plane Poiseuille Flow, Couette flow with heat transfer
- Stokes' First Problem - Introduction to similarity solutions

Dimensional Analysis - non-dimensionalization of equations, Pi theorem

Low Re flows - short introduction, Stokes Drag

Laminar Boundary Layers

- Derivation of Equations

Discussion of boundary layer control

Falkner Skan Solution

Integral Techniques

Thwaites' Method

Plane Jet Problem

Turbulence

General Introduction, What and why is turbulence?

Derivations of Reynold's Equations, Reynolds Stresses

Mixing Length Theories

Turbulent Plane Jet

Turbulent Boundary Layers, scaling laws, Law of the Wall, Law of the Wake

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus,* the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university's site on Campus Safety and Emergency Preparedness.