Ph.D. Qualifying Exam: Fluid Mechanics

Department of Mechanical Engineering University of Utah

Exam Description:

This qualifying exam will test the student's graduate-level knowledge of fluid dynamics. The reference textbooks and course material that serve as a basis for this exam are taken from ME EN 6700. Reference to the textbook from ME EN 3710 (Pritchard et al., 8th ed.) are given only as secondary study materials. The exam is focused on testing the knowledge and approach to problem solving involving fundamental concepts appropriate to the field of fluid dynamics. Among other topics, students are expected to be comfortable converting between index notation and vector notation, visualizing and explaining flow kinematics, providing a physical explanation of the terms in the Navier-Stokes equations for a given flow field, simplifying and solving the Navier-Stokes equations for some of the classic problems, applying integral analysis involving control volumes, applying dimensional analysis (both analytically and practically), and explaining basic concepts of vorticity, turbulence, boundary layers, and computational fluid dynamics.

Recommended References:

P. Kundu and I. Cohen, *Fluid Mechanics*, 4th ed., Academic Press, 2008, ISBN 9780123737359. Later editions are appropriate as well.

P. Pritchard, *Fox and McDonald's Introduction to Fluid Mechanics*, 8th ed., John Wiley & Sons, 2011, ISBN 9780470547557.

Exam Materials:

An equation sheet will be provided to students for their preparation before the exam. The same sheet will be provided with the exam. Students may bring a department issued calculator. No other materials will be allowed during the exam.

Topics:

The following table provides sources for the topics described above.

Subject	Kundu and Cohen, 4th Ed.	Pritchard, 8th Ed.
Kinematics	Ch 1-3	Ch 1,2,5
Conservation Laws	Ch 4	Ch 2,5-6
Vorticity Dynamics	Ch 5	
Dimensional Analysis	Ch 8	Ch 7,10
Boundary Layers	Ch 10	Ch 9
Turbulence	Ch 13	Ch 8