ME 441/541, Advanced Fluids, Fall 2004

Portland State University
College of Engineering and Computer Science

Class meets: 10:00-11:50PM, Mondays and Wednesdays, Room 108, Science Bldg 2

Course Objectives

Prerequisites: Admission to ME 322…math.

Textbook

Required:

- Elementary Fluid Dynamics, D.J. Acheson, Oxford Applied Mathematics and Computing Series, Clarendon Press, Oxford, 1990, or earlier.
- Tool to solve nonlinear ODEs (i.e Matlab, Mathematica, etc.), sorry.

Supplementary:

- Vectors, Tensors, and the Basic Equations of Fluid Mechanics, R. Aris, Dover Publications, Inc, New York, 1989.
- Mathematical Handbook of Formulas and Tables, M.R. Spiegel, Schaum's Outline Series, McGraw-Hill, Inc.,

Instructor

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Web site for the course: http://www.me.pdx.edu/~mmw/
Office Hours: Mon/Wed, 12:00—2:00PM, Rm 328 Science Bldg II, or by appointment

Policies

One or two take home problems (exams) and one final exam. Conflicts with exams must be resolved well before the exam dates.

Students are expected to turn in homework assignments that are substantially the result of their own work. However, students are encouraged to participate in study groups to discuss assignments, share advice, ideas, etc.

Grading

Cumulative grades will be based on the following tentative weights:
6 Homeworks (30%), 2 Take Home Problems (35%), 1 Final Exam (35%).

Very Approximate Course Outline

week	Topic	Reading Ach.
1	Another "introduction to…" lecture, Scaling, Force Balance on Fluids, Asymptotic Methods in Fluid Mechanics	1.1-1.4 chpt 2
2	Review ODEs, typical terms in Fluid mechanics	
3	Force balance Take Home Problem,	
4	Asymptotic solutions to N.S. equation, scaling, constraints, parallel flows	
5	Scaling (perhaps Take Home) 'Quiz,' Asymptotic solutions to N.S. equation, Converging flow	
6	Inviscid Flow: Waves	chpt 3
7	Potential Flow	
8	Boundary Layer Flow	chpt 8
9	Creeping Flow	chpt 7
10	Exam Review	
11	Final Exam	

Course Objectives

Understand derivation and presentation of equations of mass and momentum for analysis of fluid transport problems: identify significance of terms in equations.

Develop an 'intuition' of flow phenomena afforded by scale analysis, order of magnitude evaluation, potential flow and stream function formulations

Derive solutions for asymptotically parallel flows as well as constraints on solutions

Derive similarity solution: boundary layer flow