ENGR 4313/5443 Fluid Dynamics
Fall 2004
Department of Physics and Engineering
University of Central Oklahoma

Location	Howell Hall 100
Time	MW 5:45 p.m. - 7:00 p.m.
Instructor	Evan Lemley, Ph.D.; Assoc. Prof., Department of Physics and Engineering
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Office Hours	TR 10:00 a.m. - 11:00 a.m. & F 9:00 a.m – 10:00 a.m. or by appointment.
Final	W December 15, 2004 from 5:30 p.m. - 7:20 p.m.

Course Description
The fundamental equations and solution methods of fluid dynamics are presented with particular attention to solving the Navier-Stokes equation. Topics covered will include mass conservation, momentum and energy equations, potential flow, incompressible a nd compressible flows, viscous flow, similarity and dimensional analysis, boundary layer theory, vorticity, and turbulent flow.

Prerequisites
ENGR 3443 and MATH 3103.

Textbook
Viscous Flow, Second Edition, Frank M White, McGraw-Hill, 1991. Please bring your textbook to class for each meeting.

Calculator
You must own a scientific calculator – see the list of allowed calculators for exams in the Department of Physics and Engineering. Please bring your calculator to class for each meeting.

Engineering Paper
Engineering Paper -- available from Thompson's Bookstore or Triangle A&E at Broadway Ext. and 63rd. Please use engineering paper for all homework assignments.

Internet & E-mail
Access to the Internet and ability to send and receive E-mail. If you do not have a computer at home you can use machines on the UCO campus: Look at
http://technology.ucok.edu/support/microcomplab.htm
for a full list of available general use computers on campus.

Portable Electronic Devices (including cell phones)
Please turn off any portable electronic devices (esp. cell phones) during class. You may not access any portable electronic device during exams except calculators that are on the approved list for Physics and Engineering courses.

Topics

1. Continuum viewpoint and the equation of motion
2. Mass conservation
3. Inviscid flow–differential approach: Euler's equation, Bernoulli's integral and the effects of streamline curvature, the general form of Bernoulli's integral.
4. Control volume theorems (integral approach): linear momentum theorem, angular momentum theorem, and first and second laws of thermodynamics.
5. Navier-Stokes equation and viscous flow
6. Similarity and dimensional analysis
7. Boundary layers, separation and the effect on drag and lift
8. Vorticity and circulation
9. Potential flows; lift, drag and thrust production
10. Surface tension and its effect on flows
11. Introduction to turbulence

Instruction Techniques

Lecture will be used predominantly although sometimes recitation periods will be employed.

Class Polices

Attendance is not required, but you will responsible for any announcements or notes from class (and quizzes).

Attendance is mandatory for all exams or other graded activities (e.g. project competitions or presentations).

Cheating or academic dishonesty of any kind will not be tolerated.

Homework

Working HW problems in a timely manner is the best way to do well on exams and in the class as a whole. Homework is due at the beginning of the class period on the due-date or due-day. Homework should be neatly written on only one side of your paper, folded length-wise with your name written on the outside of the folded pages before turning it in. Each problem should fit all of the following criteria: clearly labeled, **one problem per sheet of paper**, legible and organized. HW papers that do not fit these criteria will be penalized accordingly. See the attached HW Format section for details on the presentation of HW problems. You may also visit the following site for an electronic version of the homework format requirements: http://engrphys.lemley.org/courses/hwk_format.php

Each HW problem you turn in is worth ten points. Some problems will be graded on detailed solutions and others will be graded on effort. I will **not** tell you ahead of time which or how many problems will be graded relative to a detailed solution, but on the returned and graded HW paper a check mark next to the problem number will indicate full effort (or ten points) and a numerical score (e.g. 8/10) next to the problem number will be used on those problems under more scrutiny.

Grading Policies
The following table shows the breakdown of credit for the course.

HW and misc.	15%
Exam 1	20%
Exam 2	20%
Project	20%
Final	25%
Total	**100%**

Tentative Grading Scale
90-100% -- A, 80-90% -- B, 70-80% -- C, 60-70% -- D, <60% -- F

STUDENT INFORMATION SHEET / SYLLABUS ATTACHMENT
See separate handout or go to:
http://www.busn.ucok.edu/academicaffairs/FORMS/StudentINFOFall04.pdf

Tentative Class Schedule for Fluid Dynamics Fall 2004

Week #	Day	Date	Topic	Text Sections	Covered
1	M	23Aug2004	Syllabus + Flow Introduction	1-1 – 1-2	
	W	25Aug2004	Properties + BC's	1-3 – 1-4	
2	M	30Aug2004	Reynold's Transprt Theorem + Control Volume Formulations + Continuity	2-1 – 2-3, 2-13	
	W	01Sep2004	NSL / Momentum / Navier-Stokes	2-4	
3	M	06Sep2004	**LABOR DAY – NO CLASS**		
	W	08Sep2004	COE / FLT / Energy Eq.	2-5	
4	M	13Sep2004	BC's + Gen. Coords.	2-6 – 2.7	
	W	15Sep2004	Math. Char. + Dimensional Analysis	2.8 – 2.9	
5	M	20Sep2004	Vorticity + Stream Function	2-10 – 2.11	
	W	22Sep2004	Non-Inertial Coord. Systems	2-12	
6	M	27Sep2004	**EXAM 1**		
	W	29Sep2004	Intro & Classification + Couette	3-1 – 3-2	
7	M	04Oct2004	Poiseuille Flow	3-3	
	W	06Oct2004	Poiseuille Flow	3-3	
8	M	11Oct2004	Poiseuille Flow	3-3	
	W	13Oct2004	Moving Boundaries	3-4	
9	M	18Oct2004	Suction Flows	3-6	
	W	20Oct2004	Wind Driven Flows	3-7	
10	M	25Oct2004	Similarity Solutions	3-8	
	W	27Oct2004	Creeping Flow	3-9	
11	M	01Nov2004	Intro to CFD	3-10	
	W	03Nov2004	Intro to CFD	3-10	
12	M	08Nov2004	Intro to CFD	3-10	
	W	10Nov2004	Intro to CFD	3-10	
13	M	15Nov2004	**EXAM 2**		
	W	17Nov2004	BL Integral Analysis	4-1	
14	M	22Nov2004	The Laminar BL Eqs.	4-2	
	W	24Nov2004	2-D BL Flow / Similarity Solutions	4-3	
15	M	29Nov2004	**THANKSGIVING BREAK – NO CLASS**		
	W	01Dec2004	2-D BL Flow / Similarity Solutions	4-3	
16	M	06Dec2004	Free Shear Flows	4-4	
	W	08Dec2004	Project Presentations		
17	W	15Dec2004	**Final Exam 5:30 p.m. - 7:20 p.m.**		