Chemical Engineering 374—Fluid Mechanics, Fall 2013

Location: B037 JFSB
Time: 2:00-2:50 PM, MWF
Prerequisites: Ch En 273, Math 214 or 302 or equiv, Ch En 311 (or concurrent), prof. prog. admission

Instructor: David O. Lignell
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Office Hours: M-F 4:00-5:00 PM

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Course Objectives: This course is an introduction to fluid mechanics for chemical engineers. Fluid mechanics is a very important subject with applications all around us. Fluid mechanics is the study of mass, momentum, and energy transport processes, and the design of fluid-handling systems and equipment such as piping networks, pump sizing, and fluid properties. The following broad course objectives are defined: (1) You will develop fluid mechanical skills and competencies that can be used from day-one in a professional setting for design, analays, or on an informative basis; (2) You will grow intellectually in your ability to formulate and solve engineering problems that are often not neatly packaged, but require organization and creativity; (3) You will gain an appreciation for the field of fluid mechanics that will hopefully lead to a desire for further learning and study beyond just this course. More specific course outcomes, or competencies are listed on the following pages below.

Textbook: Fluid Mechanics—Fundamentals and Applications, 3nd edition, by Cengel and Cimbala

Reading: Lectures are designed to help students learn the course content, but many details and examples are given in the text. Your learning will require repeated exposure to the material and dedicated study. Daily (almost) reading assignments are given and answers to assigned questions are due at the beginning of class on the date due.

Homework: Homework assignments will be due almost every class period. Homework is designed to help you learn the course material through direct application. You are encouraged to work in groups, but you must turn in *your own* assignment, representing *your own* work. Homework late by up to one week will be accepted for 50% credit. Homework solutions will be posted in a book kept by the department secretaries. You are on your honor not to use posted solutions in the working of late homework.

Exams: Three midterm exams and one comprehensive final exam will be administered. The final exam is scheduled for Monday, December 16, 2013 from 2:30-5:30 PM. The exam will be held in the regular lecture room unless otherwise stated. If you are unable to attend an exam you must notify me *well before* the exam, and have a *good excuse*.

Special Project: You will complete a project with a team of other students and present your results as a group at the end of the semester. The project will involve some aspect of measuring a fluid property or exploring/demonstrating a fluid phenomenon.

College Lectures: Through this course, the department requires that you attend two of the scheduled College Lectures (or two other approved technical lectures). **These are required to pass this class.**

Grading: Grades for the course will be based on the following distribution:

Homework	20%		
Reading Questions	5%	Midterm Exams (3)	45%
Special Project	10%	Final Exam	20%

Chemical Engineering 374 Competencies			
Comp.	**Level**	**Usage**	**Outcome**
3.2.4	2	M	Students will understand **mechanical behavior of materials** including elastic, viscous, surface, and stress phenomena as it pertains to fluid flow applications.
3.3.1	3	M	Students will be able to use the **mechanical energy balance** equation to solve fluid flow problems both with and without friction.
3.3.2	3	M	Students will understand and be able to describe the physical significance of key **dimensionless quantities** including Re and f.
3.3.3	2	M	Students will be able to solve simple **fluid statics** problems.
3.3.4	2	M	Students will be able to determine **velocity profiles** for steady-state, laminar flow in simple geometries for Newtonian fluids.
3.3.5	1	M	Students will understand the significance of steady-state, integral and differential **mass, energy, and momentum balances**.
3.3.7	1	M	Students will understand and be able to use advanced fluid mechanical concepts including **boundary-layer theory, creeping flow, non-Newtonian flow, rheology, and turbulent flow.**
3.3.8	2	M	Students will understand qualitatively how **external flow** around objects affects **drag** and will be able to calculate drag forces and **terminal velocities**.
3.3.9	1	M	Students will understand basic concepts relating to **compressible flow**, including Mach numbers, shock waves, and choked flow.
4.9	1	P	Students will demonstrate effective **interpretation of graphical data**.
6.1	3	P	Students will demonstrate an ability to **solve engineering problems**.
6.4	2	P	Students will exhibit critical and creative **thinking skills** for analysis and evaluation of problems and cause-effect relationships.
6.6	2	P	Students will be able to rationalize **units**, make order of magnitude **estimates**, assess reasonableness of solutions, and select appropriate levels of **solution sophistication**.
7.2	2	P	Students will understand and have a basic knowledge of how **safety considerations** are incorporated into engineering problem solving.
7.4	2	P	Students will understand and have a basic knowledge of how **environmental considerations** are incorporated into engineering problem solving.
10.3.1	3	M	Students will be able to calculate **pressure drop** in flow systems involving pipes and pumps for **non-Newtonian** fluids.
10.3.2	2	M	Students will be able to **select**, based on performance characteristics and operational constraints, the appropriate kind of **pumps** (positive displacement, radial, axial, etc.), **turbines** (impulse, Francis, Kaplan, etc), and **valves** for a given application.
10.3.3	2	M	Students will be able to **design flow systems** involving pipes and pumps for **power-law fluids.**
10.3.4	1	I	Students will be familiar with the use of **computational fluid dynamics** as a tool for solving fluid flow in complex geometries.
12.8	1	P	Students will demonstrate effective **reading of technical materia**l.
Levels	1- exposure to material, but may not be assessed		
	2- competency assessed in course		
	3- competency is assessed in course at again before graduation		
Usage	M=main course content; P=developed throughout the program; I=Introduction		

BYU Policy Statements

Academic Honesty

The first injunction of the BYU Honor Code is the call to be honest. Students come to the university not only to improve their minds, gain knowledge, and develop skills that will assist them in their life's work, but also to build character. President David O. McKay taught that "character is the highest aim of education" (The Aims of a BYU Education, p. 6). It is the purpose of the BYU Academic Honesty Policy to assist in fulfilling that aim. BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including but not limited to plagiarism, fabrication or falsification, cheating, and other academic misconduct.

Honor Code Standards

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Preventing Sexual Harassment

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds. The act is intended to eliminate sex discrimination in education. Title IX covers discrimination in programs, admissions, activities, and student-to-student sexual harassment. BYU's policy against sexual harassment extends not only to employees of the university, but to students as well. If you encounter unlawful sexual harassment or gender-based discrimination, please talk to your professor; contact the Equal Employment Office at 422-5895 or 367-5689 (24-hours); or contact the Honor Code Office at 422-2847.

Students with Disabilities

Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the Services for Students with Disabilities Office (422-2767). Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. Services are coordinated with the student and instructor by the SSD Office. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution through established grievance policy and procedures by contacting the Equal Employment Office at 422-5895, D-285 ASB.