

ME/CEE 2342 – FLUID MECHANICS

J-term Syllabus

Instructor: Dr. Paul Krueger
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Lectures: Location TBD

Website: TBD (probably through Blackboard (courses.smu.edu))

Course Description:

An introduction to the concept of a fluid and how to apply the laws of motion to both static and moving fluids. Topics include static forces on submerged surfaces, Bernoulli's equation, fluid motion in control volumes, differential equations of fluid motion, irrotational flow, similitude and dimensional analysis, flow in conduits, boundary layer theory, lift and drag.

Prereqs: ME 2310 (Statics), Math 2339 (Calc III), Phys 1303 (Introductory Mechanics) [ME 2320 (Dynamics) is highly encouraged], Math 2343 (Differential Equations)

Required

Textbook: Cengel and Cimbala, Fluid Mechanics: Fundamentals and Applications, 3rd Ed., McGraw Hill, 2014.

Grading:	Class Participation	10%
	Exams (4)	22.5% each

Homework and Exam Policies:

Homework will be assigned at the end of each day (except the last day). The homework is provided as an exercise for the students, but will not be graded. Homework and additional exercises will be discussed in class and in groups. Participation in the group discussions will be weighted heavily in the class participation grade.

Four exams will be given during the J-Term (Jan. 7, 9, 13, and 15). The exams comprise the majority of the grade for the course.

Lecture Policies:

Class attendance is mandatory. The class time will be divided between lecture, homework/exercise discussion groups, and exams. A typical daily schedule will be as follows:

9 – 10:20	Lecture
10:20 – 10:30	<i>Break (10 min)</i>
10:30 – 11:30	Lecture
11:30 – 12:00	Homework and in-class exercise discussion group
12:00 – 1:00	<i>Lunch (1 hour)</i>
1:00 – 2:20	Lecture or Exam. Exams will be held on Jan. 7, 9, and 13 during this period.
2:20 – 2:30	<i>Break (10 min)</i>
2:30 – 4:00	Lecture or Exam. An exam will be held on Jan. 15 during this period.

Some Recommended References:

1. White, Fluid Mechanics, McGraw-Hill.
2. Fox and McDonald, Introduction to Fluid Mechanics, John Wiley and Sons.
3. Munson, Young, and Okiishi, Fundamentals of Fluid Mechanics, John Wiley and Sons.

Notices:

University Honor Code: The SMU Honor Code applies to all work performed in this class (see http://smu.edu/studentlife/PCL_05_HC.asp). Giving or receiving dishonest aid on homework or exams, or toleration of such action, constitutes an Honor Code violation. An example of an Honor Code violation is submitting for evaluation a homework assignment that was completed with the aid of a solution set or was directly copied from a classmate (solutions from two different students should not look the same!). Honor code violations will be dealt with by the instructor and referred to the Honor Council if necessary.

Disability Accommodations: Students needing academic accommodations for a disability must first be registered with Disability Accommodations & Success Strategies (DASS) to verify the disability and to establish eligibility for accommodations. Students may call 214-768-1470 or visit <http://www.smu.edu/alec/dass> to begin the process. Once registered, students should then schedule an appointment with the professor to make appropriate arrangements.

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)

Course Outcomes:

- A. An ability to apply knowledge of mathematics, science, and engineering.
- E. An Ability to identify, formulate, and solve engineering problems.
- K. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Lecture Schedule

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Date (Day)	Topics	Reading	Homework
1/6 (M)	Introduction; Definitions and Properties Fluid Statics – Pressure; Pressure measurement (Manometers) Fluid Statics – Forces on flat, submerged surfaces Fluid Statics – Forces on curved submerged surfaces, buoyancy	Syllabus; 1-1 – 1-10, 2-1 – 2-6, 3-1 – 3-6	1-26, 2-13, 2-81 , 3-38, 3-49 , 3-51, 3-77E , 3-79 , 3-86, 3-99, 3-169
1/7 (Tu)	Fluid Kinematics Control Volume Analysis (CVA) – Conservation of Mass; Reynolds Transport Theorem CVA – General Energy Equation EXAM 1 (1:00 P.M.)	4-1 – 4-3, 4-6; 5-1 – 5-3, 5-5 – 5-6	4-17 , 4-35 , 4-47E , 5-15 , 5-17, 5-100, 5-83, 5-95 , 5-97
1/8 (W)	Bernoulli's Equation – Theory Bernoulli's Equation – Examples CVA – Newton's 2 nd Law (Momentum An.) Newton's 2 nd Law Examples	5-4, 6-1 – 6-4	5-30C, 5-38C , 5-43, 5-50E , 5-60, 6-29E , 6-37E, 6-38, 6-80
1/9 (Th)	Dimensional Analysis – Pi Theorem; Dimensional Analysis – Common dimensionless groups; Theory of Models Pipe Flow – Laminar EXAM 2 (1:00 P.M.)	7-1 – 7-5	7-4, 7-49, 7-51 , 7-37 , 7-39 , 7-83, 8-10C, 8-23C , 8-50
1/10 (F)	Pipe Flow – Turbulent (Moody Chart) Pipe Flow – Minor losses, Open Channel Flow Differential Analysis (DA) – Conservation of Mass; Stream Function; DA – Newton's 2 nd Law; N-S Equations	8-1 – 8-6 (8-7, 8-8); 9-1 – 9-4, 4-5	8-39, 8-154 , 8-132 , 8-66, 8-78E , 8-91 , 9-30 , 9-35 , 9-64E , 4-99
1/13 (M)	DA – Basic solutions Inviscid Flow (Potential Flow) EXAM 3 (1:00 P.M.)	9-6, 10-4, 10-5	9-86, 9-88 , 10-58, 10-60, 10-71
1/14 (Tu)	Boundary Layers – Reynolds No. Behavior; Basic Equations; Flat Plate BL BLs – δ , δ^* and θ ; Turbulent boundary layers Drag (BL Separation, C_D , Flat Plates)	10-6, 11-1 – 11-6	10-73C , 10-87, 10-90E , 11-15C, 11-55E , 11-57, 11-29, 11-35 , 11-69 For material covered on Wednesday: 11-91 , 11-95
1/15 (W)	Lift Review EXAM 4 (2:30 P.M.)	11-7	

Disclaimer: The lecture schedule is tentative and subject to change.

Note: It is highly recommended that students purchase the text book and read at least the first four (4) chapters BEFORE class begins on Jan 6.