Fall 2019

MECH 3314 (16988) FLUID MECHANICS

Course Description

Fluid properties, fluid statics, fluid flow concepts and basic equations, dimensional analysis, viscous effects, fluid resistance, laminar and turbulent boundary layers, flow-through pipes. ***Prerequisite is MECH 2311 Intro to Thermal-Fluid Science with a 'C' or better.***

Instructor

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Office Hours: TR 1400 – 1500 by appointment.

Textbook

Fluid Mechanics: Fundamentals and Applications 4th Edition (2017)
by Yunus Cengel and John Cimbala
McGraw Hill

Course Content

1. Review of Basic Concepts
2. Conservation of Mass
3. Bernoulli's Equation
4. Energy Equation
5. Conservation of Momentum
6. Dimensional Analysis
7. Internal Flows
8. External Flows
9. Compressible Flows
10. Turbomachinery

Grading

Quizzes	200
Tests (4 given - 3 best will count)	300
Projects	200
Comprehensive Final	100
Possible Points	**800**

A (800-720): B (719-640): C (639-560): D (559-480): F (479 and Below)

There will be several homework assignments, quizzes, four 80-minute tests, and two projects given during the semester. There will be no makeups for the tests or quizzes. Your lowest test grade will be dropped.

The projects will consist of small design type problems that you will have to complete. These projects will be detailed either in class or on Blackboard.

Learning Objectives

Upon completion of this course, students should be able to:

1. Articulate the properties that distinguish fluids from other forms of matter, and the broad range of engineering applications which involve fluid mechanics.
2. Apply the concepts of flow physics through the conservation laws.
3. Properly apply Newton's second law to analysis and design involving fluids at rest using integral and differential calculus.
4. Properly apply systems and control volume methods based on mass, and momentum conservation, as appropriate, to the analysis and design of engineering fluids systems.
5. Properly apply mass and momentum conservation to steady internal (pipe) flows, correctly interpret and apply laminar and turbulent flow models, and estimate head loss and power requirements in piping systems.
6. Develop mathematical models through justifiable *approximations*, correctly interpret and apply the "inviscid" approximation and the "Bernoulli" relationships to analysis of fluid systems, and estimate levels of approximation in engineering models.
7. Apply basic principles of dimensional homogeneity to engineering analysis, and apply dimensional analysis and similitude to the representation of data. Properly interpret the Reynolds number and other fundamental nondimensional parameters.
8. Apply integral methods, and basic empirical and theoretical models, to the analysis of boundary layer flows, and to drag on bodies.
9. Apply fundamental knowledge of fluid mechanics to the analysis of specific sensors and instruments used in fluid-flow experiments.
10. Apply basic software tools (especially spreadsheets) to the analysis of experimental data and mathematical models.
11. Demonstrate professionalism, and respectful interaction with faculty and colleagues.

Policy for Quizzes

Quizzes will be based on helping you study for the Fundamental of Engineering (FE) and Principles of Engineering / Professional Engineering (PE) exams (http://www.ncees.org/exams/).

I recommend that you use an approved calculator similar to what you will use for your certification exams for all your work since this will help you learn how to use all the features of your calculator. These calculators include Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name, Hewlett Packard: The HP 33s and HP 35s models, and Texas Instruments: All TI-30X and TI-36X models.

Academic dishonesty

All graded materials must represent the student's individual work. Scholastic dishonesty is the attempt of any student to present as his or her own work of another, or any work which he has not

honestly performed, or attempting to pass any examination by improper means. ***Scholastic dishonesty is a serious offense and will not be accepted***. Academic misconducts will be handled according to the current university policy.

Reasonable Accommodation Policy: If you need classroom accommodation, please contact The Center for Accommodations and Support Services (CASS) at 915-747-5148, or by email to cass@utep.edu , or visit the office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

Department of Mechanical Engineering Safety Statement

The Department of Mechanical Engineering at the University of Texas at El Paso is committed to a model of excellence in education that includes providing a safe and healthy environment for its students, staff, faculty and the general public.

Our goal is to maximize education and research training that can only occur if you, the individual, minimize hazards and risks. This can be done by:

- Providing adequate control of the health and safety risks arising from any and all activities;
- Consulting with employees on matters affecting their health and safety
- Providing and maintaining safe laboratories and equipment;
- Ensuring safe handling and use of substance;
- Ensuring all employees are competent to do their task and have adequate training; and
- Maintaining clean, safe and healthy working conditions

The principal investigator or individual in charge of each laboratory is ultimately responsible for safety in that respective lab. This includes training and ultimate release of the laboratory. Within the Department, we hold every employee (staff, faculty, student) responsible for implementing our safety practices and our departmental safety policy. We hold every employee (staff, faculty, student) responsible for providing leadership within our department to establish effective environmental safety and occupational health standards.

CLASS SCHEDULE
MEETING TIME: TR 1200-1320
MEETING LOCATION: Liberal Arts Building 323

Week	Dates	Chapter(s)	Read Sections	Self-Study Problems	Due
1	08/27	1 – Intro	1.1-10	-	-
		2 – Properties of Fluids	2.1-3, 2.5-6	2-9, 2-13, 2-14, 2-74, 2-79, 2-80	
	08/29	3 – Fluid Statics	3.1-4, 3.6	3-12, 3-13, 3-18, 3-19, 3-26, 3-32, 3-38, 3-45, 3-47, 3-55, 3-67, 3-69, 3-71, 3-74, 3-75, 3-77	**Quiz 1 – 08/29- Covering Chaps. 1 and 2**
2	09/03	3 – Finish Fluid Statics	3.1-4, 3.6	-	-
	09/05	5- Mass and Bernoulli Eqns.	5.1-6	5-9, 5-12, 5-13, 5-15, 5-17, 5-22, 5-26, 5-42, 5-52, 5-60, 5-62, 5-63, 5-79, 5-84, 5-87, 5-89	**Quiz 2 – 09/05- Covering Ch. 3**
3	09/10	5- Mass and Bernoulli Eqns.	5.1-6	-	-
	09/12	6 – Momentum Analysis	6.1-2 6.4	6-17, 6-18, 6-21, 6-22, 6-23, 6-27, 6-34, 6-35, 6-48, 6-95	**Quiz 3-09/12- Covering Ch. 5**
4	09/17	Test Review 1 Chapters 1,2,3, and 5	Week 1-3 readings	Week 1-3 Self-Study Problems	-
	09/19	-	-	-	**TEST 1 09/19 Chaps. 1, 2, 3**

					and 5
5	09/24 09/26	7 – Dimensional Analysis -	7.1-4 -	7-16, 7-21, 7-22, 7-37, 7-39, 7-49, 7-54 -	- **Quiz 4 – 09/26- Covering Chap. 6**
6	10/01 10/03	8 – Internal Flows -	8.1-6 8.8 -	8-12, 8-33, 8-34, 8-37, 8-39, 8-40, 8-43, 8-46, 8-50, 8-51, 8-55, 8-63, 8-66 -	- **Quiz 5 – 10/03- Covering Chap. 7**
7	10/08 10/10	Test Review 2 Chapters 6, and 7 -	Week 4-6 readings -	Week 5-6 Self-Study Problems -	- **TEST 2 10/10 Chaps. 6, and 7**
8	10/15 10/17	11 – External Flows -	11.1-4 -	11-21, 11-23, 11-24, 11-29, 11-31, 11-33, 11-34, 11-41 **PROJECT 1 ASSIGNED**	- **Quiz 6 – 10/17- Covering Chap. 8**
9	10/22 10/24	11 – External Flows -	11.5-7 -	11-50, 11-51,11-53, 11-57, 11-59, 11-64, 11-66, 11-68, 11-70, 11-72, 11-85, 11-87, 11-89	- **Quiz 7 – 10/24- Covering Chap. 11**
10	10/29	Test Review 3 on your own	Week 8 and 9 readings	Week 8 and 9 Self-Study	-

		Chapters 8, 11, and 12		Problems	
	10/31 **Course Drop Deadline: Nov 1st**	-	-	-	**TEST 3 10/31 Chaps. 8 and 11**
11	11/05 11/07	12 – Compressible Flow -	12.1 – 3 12.4	12-4, 12-6, 12-7, 12-10, 12-19, 12-22, 12-23, 12-25, 12-40, 12- 48, 12-62, 12-65, 12-62 **PROJECT 2 ASSIGNED**	- **Quiz 8 – 11/07 - Covering Chap. 12**
12	11/12 11/14	14 – Turbomachinery -	14.1-2 -	14-28, 14-35, 14-36, 14-39, 14-43, 14-58, 14-60, 14-62	- **Quiz 9 – 11/14- Covering Chap. 14**
13	11/19 11/21	14 – Turbomachinery -	14.4 -	Work on and Finish Class Project 1 -	- **<u>Class Project 1 DUE – 11/21</u>**
14	11/26 11/28 **Thanksgiving Holiday: November 28 and 29**	14 – Turbomachinery **UNIVERSITY CLOSED THANKSGIVING HOLIDAY**	- -	Work on and Finish Class Project 2	**Quiz 10 – 11/26- Covering Chap. 12 and 14**
15	12/03	Test Review 4 Chapters 12 and 14	Week 11-14 readings	Week 11-14 Self-Study Problems	**<u>Class Project 2 DUE – 12/03</u>**

	12/05				**TEST 4 12/05 Chaps. 12 and 14**
16	**COMPREHENSIVE FINAL EXAM Tuesday December 10th 1300 - 1545**				