Course Details:

Course Description:	"Fundamentals of Engineering Fluids" examines the theoretical bases for fluid statics and dynamics, including the conservation of mass, energy and momentum. Modeling of hydraulic systems are introduced. Pipe flow and open-channel hydraulics are emphasized with application to real-world problems.
Course Rationale:	The rationale for this course is to gain fundamental knowledge of compressible and incompressible fluids; understand fluid properties, dimensions, and units; learn the fundamental laws of mechanics as applied to fluids; understand the limitations of theoretical analysis and the determination of correction factors and friction factors; apply the relevant theory to problem solving exercises.
Prerequisites:	ENES220, PHYS260, and PHYS261; and permission of ENGR-Civil & Environmental Engineering department.
Course Schedule:	Monday, Wednesday, and Friday 10:00-10:50 AM
Instructor:	Professor Barton Forman Office Location: Online meeting format via course Zoom link Office Hours: Tuesday and Thursday 10:30 – 11:30 AM (or by appointment) Email: `baforman@umd.edu` ELMS: `https://umd.instructure.com/`
Teaching Assistant:	Lizhao Wang Office Location: Online meeting format via course Zoom link Office Hours: Tuesday and Thursday 3:30 – 4:30 PM Email: `lzwang@umd.edu` ELMS: `https://umd.instructure.com/`
Recommended Text:	R.C. Hibbeler *Fluid Mechanics*
Grading Basis:	Homework: 20% Exams (3): 50% Final Exam: 30% **Homework is due by the start of lecture.** **No make-up exams allowed.***
Honor Pledge:	The university has a nationally recognized Honor Pledge, administered by the Student Honor Council. The Student Honor Council proposed and the university Senate approved an Honor Pledge. The University of Maryland Honor Pledge reads: "I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination." This pledge was designed to promote academic integrity by the student body and emphasize the importance of the university academic policies. Additional course-related policies established by the University can be found at `http://www.ugst.umd.edu/courserelatedpolicies.html`.

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*Unless due to extenuating circumstances

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Class Logistics:	The tentative class schedule, including topics to be covered, is listed below. The course is organized into two parts: 1) lecture-based survey of the basics of fluid mechanics, and 2) a series of homework assignments and examinations designed to test your mastery of the material.

Tentative Course Schedule (subject to change):

#	Lecture Date	Topics Covered
1	Monday, January 25	Discussion of course syllabus; basic introduction to fluids; concept of a fluid; fluid dimensions and units; [Read Cha. 1];
2	Wednesday, January 27	Ideal gas law; shear stress in a fluid;
3	Friday, January 29	Viscosity; Newtonian versus non-Newtonian fluids; elasticity and compressibility;
4	Monday, February 1	Surface tension; vapor pressure; fluid statics; [Read Cha. 2; skip 2.14];
5	Wednesday, February 3	Fluid statics;
6	Friday, February 5	Measurement of static pressure; hydrostatic examples;
7	Monday, February 8	Concept of pressure distribution; forces acting on a flat surface;
8	Wednesday, February 10	Forces acting on a curved surface; buoyancy;[†]
9	Friday, February 12	Characterizing flowing fluids; [Read Cha. 3];
10	Monday, February 15	Fluid acceleration; Euler's equation; [Read Cha. 5.1, 5.2, and 5.3
11	Wednesday, February 17	Bernoulli's equation;
12	Friday, February 19	Measurement of fluid velocity;
–	Monday, February 22	**Exam #1**
13	Wednesday, February 24	Quantifying fluid flow;
14	Friday, February 26	Concept of control volume; Reynolds transport theorem; [Read Cha. 4];
15	Monday, March 1	Continuity equation;
16	Wednesday, March 3	Predicting cavitation;[‡] momentum equation for a stationary control volume; [Read Cha. 6; skip 6.5]
17	Friday, March 5	Momentum equation for a stationary control volume (continued); [Read Cha. 6];
18	Monday, March 8	Momentum equation for a stationary control volume (continued)
19	Wednesday, March 10	Momentum equation for a moving control volume; angular momentum;
–	Friday, March 12	**Exam #2**

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[†]End of Exam #1 material

[‡]End of Exam #2 material

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#	Lecture Date	Topics Covered
–	Monday, March 15	No Lecture (Spring Break)
–	Wednesday, March 17	No Lecture (Spring Break)
–	Friday, March 19	No Lecture (Spring Break)
20	Monday, March 22	Concept of work, energy, and power; conservation of energy equation [Read Cha. 5.5];
21	Wednesday, March 24	Conservation of energy equation (continued);
22	Friday, March 26	Kinetic energy;
23	Monday, March 29	Power equation; mechanical efficiency;
24	Wednesday, March 31	Hydraulic grade line; energy grade line; dimensional analysis; [Read Cha. 5.4; Read Cha. 8];
25	Friday, April 2	Dimensional analysis (continued); similitude;[§]
26	Monday, April 5	Classifying flow in a conduit; Darcy-Weisbach equation; [Read Cha. 10];
27	Wednesday, April 7	Stress distribution in pipe flow; laminar flow in a tube; [Read Cha. 9.3 – 9.8];
28	Friday, April 9	Turbulent flow in a tube; Moody diagram;
–	Monday, April 12	Combined head loss; hydraulic radius;
29	Wednesday, April 14	System of pumps and pipes;
30	Friday, April 16	**Exam #3**
31	Monday, April 19	Introduction to open channel flow; energy equation for steady open channel flow; steady uniform open channel flow; [Read Cha. 12];
32	Wednesday, April 21	Chezy equation; Manning equation;
33	Friday, April 23	Steady, nonuniform flow; rapidly varied flow; characteristics of critical flow;
34	Monday, April 26	Occurrence of critical flow; wave celerity; hydraulic jump;
35	Wednesday, April 28	Hydraulic jump in rectangular channels;
36	Friday, April 30	Gradually varied flow; equation of motion for steady and uniform laminar flow; [Read Cha. 9.1 – 9.2];
37	Monday, May 3	Flow produced by a moving plate; flow between stationary parallel plates;
38	Wednesday, May 5	Description of a boundary layer; introduction to turbomachinery; propellers; [Read Cha. 11.1 – 11.2; Read Cha. 6.5];
39	Friday, May 7	Axial-flow pumps; radial-flow pumps; turbines; [Read Cha. 14; skip 14.4 – 14.9];
40	Monday, May 10	Course review and summary;
–	Wednesday, May 19	**Final Examination (8:00 AM – 10:00 AM)**

[§] End of Exam #3 material

Homework:

Thirty-seven (37) homework problem sets will be assigned. Each homework assignment will be due by the beginning of class. These assignments are designed to reinforce your basic understanding of the theory covered in the lectures. Due to limited lecture time, some concepts and applications may be introduced in the homework assignments. It is your responsibility to know the material not only covered in lectures, but the material covered in the book and homework assignments, too.

Assignments:

Problem Set #	**Assigned Date**	**Due Date**
1	Wednesday, January 27	Friday, January 29
2	Friday, January 29	Monday, February 1
3	Monday, February 1	Wednesday, February 3
4	Wednesday, February 3	Friday, February 5
5	Friday, February 5	Monday, February 8
6	Monday, February 8	Wednesday, February 10
7	Wednesday, February 10	Friday, February 12
8	Friday, February 12	Monday, February 15
9	Monday, February 15	Wednesday, February 17
10	Wednesday, February 17	Friday, February 19
11	Friday, February 19	Wednesday, February 24
12	Wednesday, February 24	Friday, February 26
13	Friday, February 26	Monday, March 1
14	Monday, March 1	Wednesday, March 3
15	Wednesday, March 3	Friday, March 5
16	Friday, March 5	Monday, March 8
17	Monday, March 8	Wednesday, March 10
18	Wednesday, March 10	Monday, March 22
19	Monday, March 22	Wednesday, March 24
20	Wednesday, March 24	Friday, March 26
21	Friday, March 26	Monday, March 29
22	Monday, March 29	Wednesday, March 31
23	Wednesday, March 31	Friday, April 2
24	Friday, April 2	Monday, April 5
25	Monday, April 5	Wednesday, April 7
26	Wednesday, April 7	Friday, April 9
27	Friday, April 9	Monday, April 12
28	Monday, April 12	Wednesday, April 14
29	Wednesday, April 14	Monday, April 19
30	Monday, April 19	Wednesday, April 21
31	Wednesday, April 21	Friday, April 23
32	Friday, April 23	Monday, April 26

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Problem Set #	**Assigned Date**	**Due Date**
33	Monday, April 26	Wednesday, April 28
34	Wednesday, April 28	Friday, April 30
35	Friday, April 30	Monday, May 3
36	Monday, May 3	Wednesday, May 5
37	Wednesday, May 5	Friday, May 7

Instructions for Completing Assignments:

When doing the assigned homework problems, the following guidelines must be followed in order to receive full credit:

1. Put your name in the upper right corner of the paper.
2. Put the problem number in the upper left corner of the paper.
3. Show all calculations to a minimum of three significant digits.
4. Clearly underline or box all of your answers.
5. Write all assumptions at the beginning of the problem and include diagrams where necessary.
6. Show all of your work in an orderly fashion and do not skip steps ... the homework grade is not solely based on the final answer.
7. If you work with someone on the homework, indicate the person's name in the upper left corner of the paper below the problem number.
8. Upload homework as a PDF file per the course website requirements.
9. Do <u>not</u> copy someone else's work ... this is plagiarism.