CE 2375 – Introduction to Fluid Mechanics – Spring 2020

The University of Texas at El Paso
Department of Civil Engineering
Class Time: MWF 8:30am-9:20pm
Class Location: Class Room Building C305
CRN: 22680
Prerequisites: MATH 1312 Calculus II

Instructor: AHM Golam Hyder
Email: ahyder@miners.utep.edu
Office hours: Friday, 11am-12pm,
Civil Engineering Study Hall
Faculty Mentor: W. Shane Walker, Ph.D., P.E.

Required Course Materials:

1. **Pearson's MasteringEngineering (CE2375S2020WALKER).** The purchase for access to this MasteringEngineering homework can also be made in combination with the textbook.
2. **Hibbeler (2018) Fluid Mechanics (Second Edition), Pearson (9780134649290)**
   Here are three options to purchase the textbook with the MasteringEngineering access:
   - Bundle: Bound Text + Modified MasteringEngineering Access Card (ISBN: 9780134675862)
   - Bundle: Loose-leaf Text + Modified MasteringEngineering Access Card (ISBN: 9780134675848)
   - Modified MasteringEngineering with eText Access Card (ISBN: 9780134629155)

Supplemental Texts:

- Finnemore & Franzini, Fluid Mechanics with Engineering Applications, Tenth Edition, McGraw Hill
- Cengel, Cimbala, & Turner, Fundamentals of Thermal-Fluid Sciences, Fourth Edition, McGraw Hill

Description and Objectives

This course involves a study of the fundamental theory of fluid mechanics, and the topics included in this course are:

1. Fluid properties
2. Fluid statics (e.g., hydrostatics)
3. Conservation of Mass (e.g., continuity, Reynolds Transport Theorem)
4. Conservation of Energy (e.g., The Bernoulli Equation, Hydraulic Grade Lines)
5. Conservation of Momentum
6. Dimensional Analysis & Similitude
7. Flow through Closed-Conduits
8. Open-Channel Flow
9. Pumps and Turbines
10. Compressible Flow

Expectations

Class Sessions: Each class meeting will be 8:30am – 9:20am (see schedule below).
Participation: More than simply attending class, you are invited to *think,* and *participate* in the lectures and discussions. I encourage you to be curious and inquisitive during class discussions and online forums.
Preparedness: I recommend that you bring the textbook, a personal course notebook, a pen or pencil, a calculator, completed homework assignments, and questions from the homework and assigned reading.
Punctuality: You are expected to be on time to class, laboratory exercises, and plant tours. Late assignments will not be accepted.
Ethics: In engineering, personal integrity is of utmost importance, especially in the assessment and reporting of environmental conditions. Also, in most cases, it is necessary to work in teams to develop and design optimal solutions to problems and challenges, and it is essential that each team member contribute to the productivity of the team. In this course, I strongly recommend that you complete homework assignments in teams; in many cases, you will help each other through the solution of difficult problems. My goal for the homework is for you to develop proficiency in the basic application and calculations in design. Thus, every student is accountable for *understanding* the concepts, analysis, and solution. Any student committing

plagiarism (*e.g.*, copying another's work without understanding) or any other form of academic dishonesty will be reported to the Dean of Students for disciplinary action (which may include expulsion from the University). For a concise summary of engineering ethics, I have provided here the Fundamental Canons within the Code of Ethics of the American Society of Civil Engineers (ASCE):

1. *Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development3 in the performance of their professional duties.*
2. *Engineers shall perform services only in areas of their competence.*
3. *Engineers shall issue public statements only in an objective and truthful manner.*
4. *Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.*
5. *Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.*
6. *Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.*
7. *Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.*

Homework

Homework assignments will be completed through Pearson's MasteringEngineering (available from https://www.masteringengineering.com/site/login.html). You can register and purchase access to this course at https://www.pearsonmylabandmastering.com/northamerica/masteringengineering/ with Course ID: **CE2375S2020WALKER**. H**omework assignments are expected to require AT LEAST 4-6 HOURS PER ASSIGNMENT (outside of class).** Each class period will have a corresponding homework assignment (available in MasteringEngineering the previous day). The homework assignment associated with each class session will be due before the following class period. If you score less than 90% on a homework assignment, then you will automatically be assigned two additional required homework problems related to that assignment (called "Adaptive Follow-Up"); these Adaptive Follow-Up assignments are required and count as part of your overall Homework grade and will be due one day after the parent assignment is due. If you score greater than 90% on a homework assignment and complete all problems within that assignment, then you will automatically receive 100% credit for the Adaptive Follow-Up associated with that assignment.

Your average homework grade constitutes a significant fraction of your overall course grade, so I strongly urge you to give your full devotion to understanding and mastering the concepts in the homework assignments. Moreover, the exams are based on the concepts in the homework, so as you diligently study to understand the concepts in the homework assignment, you are implicitly studying for the exams. In this "information age" with Google search at our fingertips, it might be tempting to search the internet for solution steps to the homework problems, but BEWARE: COPYING SOMEONE ELSE'S SOLUTION DESTROYS YOUR INTELLIGENCE. The main points of engineering education are to learn fundamental principles and to train yourself how to innovate and solve complex problems. If you rely on examples and posted solutions, you rob yourself of the mental effort that is required to force your brain to learn out how to FIGURE OUT STUFF ON YOUR OWN. I liken engineering education to wilderness survival training. Of course, you need someone to prepare you with some basic principles and skills of how to search for water, food, and basic shelter, but at some point, you have to be dropped out in the middle of the wilderness to learn how to survive. So, I strongly encourage you to make sure that you understand each homework problem as you solve them!

Quizzes

We will be using a cloud-based student response software by iClicker in class this semester for quizzing and polling. You will need to create an iClicker Reef Student account to participate in class using your laptop, smart phone, or tablet connected to the university's Wi-Fi (UTEPSecure) or to your mobile data plan. Sign in to Blackboard (available from https://my.utep.edu/) and click the link for this course. Click the iClicker REEF icon on the Home Page to launch a special instance of REEF, then log in, or create a new REEF account if you don't already have one. **When creating your account, use your university email address** (username@miners.utep.edu). You will NOT need to purchase a subscription to use iClicker REEF this

semester because it is provided to you for FREE. Signing into REEF through the link in Blackboard will automatically add you to my course. When asked to register a remote device, choose "not at this time". Note: submitting votes for a fellow student is considered cheating and a violation of the University Honor Code and the Civil Engineering Honor Code. If you are caught voting for another student or have votes in a class that you did not attend, you will be referred to OSCCR for disciplinary action.

Exams

All exams are closed-book and closed-notes; that is, you are not allowed to use your textbook or any other references (printed, hand-written, electronic, digital, audio, video, etc.) other than those provided to you by the professor in or with the exam. Following NCEES policy (http://ncees.org/exams/calculator/), the only calculator models acceptable for use during exams are as follows:

- Casio: All fx-115 and fx-991 models (must have "fx-115" or "fx-991" in its model name)
- Hewlett Packard: The HP 33s and HP 35s models, but no others
- Texas Instruments: All TI-30X and TI-36X models (must have "TI-30X" or "TI-36X" in its name)

At the end of the exam, you will be asked to sign two ethical statements:

- *I have maintained ethical integrity and have not committed any form of academic dishonesty in accordance with the UTEP Handbook of Operating Procedures, the UTEP Civil Engineering Honor Code, and the ASCE Code of Ethics.*
- *I have not witnessed any other student commit any form of academic dishonesty with regard to this exam.*

These two statements, respectively, are analogous to your engineering ethical obligations to (1) certify your own work with your engineer's seal and (2) report unethical behavior performed by other engineers. If you do not sign agreement to one or both of the ethics statements, then I will email you to schedule a private discussion in my office. If you reveal unethical behavior (such as academic dishonesty) performed by another individual, then I will submit a report to the Office of Student Conflict and Conflict Resolution (OSCCR) for their investigation.

Evaluation: Overall Weighted-Average Course Score

Assessment of your performance in this course will be determined by class attendance and participation, homeworks, quizzes, and exams. (No makeup exams will be offered.) The overall weighted-average score is calculated as:

Evaluation	Contribution (%)
Homework	35
Quizzes	10
Midterm Exams (4)	35
Final Exam (comprehensive)	20
Total	*100*

Final Letter Grade

A final exam score of at least 50% is required to pass the course. The final course letter grade will be determined according to the following:

Course Average (%)	Grade
≥ 90	A
80-89	B
70-79	C
60-69	D
< 60	F

I reserve the right to modify or augment this grading scheme for the sake of improving the educational effectiveness of this course.

Special Accommodations

The University of Texas at El Paso provides, upon request, appropriate academic accommodation for students with disabilities. For more information, contact the Center for Accommodations and Support Services (https://www.utep.edu/student-affairs/cass/).

Course Schedule

#	Date	Day	Text	Description	HW
1	Jan 20	Mon		*Dr. Martin Luther King, Jr. Holiday-No Class*	
2	Jan 22	Wed	1.1-10	Fluid Mechanics: Fundamental Concepts	1
3	Jan 24	Fri	2.1-6	Fluid Statics: Pressure Variation	2
4	Jan 27	Mon	2.7-10	Fluid Statics: Hydrostatic Force on a Surface	3
5	Jan 29	Wed	2.11-12	Fluid Statics: Buoyancy and Stability	4
6	Jan 31	Fri	3.1-3	Kinematics: Fluid Flow	5
7	Feb 03	Mon	3.4-5	Kinematics: Acceleration	6
8	Feb 05	Wed	4.1-2	Conservation of Mass: Flow, Velocity, and Control Volumes	7
9	Feb 07	Fri	-	Exam 1 Review	-
10	**Feb 10**	**Mon**	**1-3**	**EXAM 1**	**1-6**
11	Feb 12	Wed	4.3	Conservation of Mass: The Reynolds Transport Theorem	8
12	Feb 14	Fri	4.4	Conservation of Mass: Continuity Equation	9
13	Feb 17	Mon	5.1	Conservation of Energy: Euler's Equations of Motion	10
14	Feb 19	Wed	5.2-3	Conservation of Energy: The Bernoulli Equation	11
15	Feb 21	Fri	5.4	Conservation of Energy: Energy and Hydraulic Grade Lines	12
16	Feb 24	Mon	5.5	Conservation of Energy: The Energy Equation	13
17	Feb 26	Wed	6.1-2	Conservation of Momentum: The Linear Momentum Equation	14
18	Feb 28	Fri	6.3	Conservation of Momentum: Constant Velocity	15
19	Mar 02	Mon	6.4-5	Conservation of Momentum: Angular Momentum, Propellers, and Turbines	16
20	Mar 04	Wed	8.1-4	Dimensional Analysis & Buckingham Pi Theorem	17
21	Mar 06	Fri	-	Exam 2 Review	-
22	**Mar 09**	**Mon**	**4-6**	**EXAM 2**	**7-16**
23	Mar 11	Wed	8.5	Similitude	18
24	Mar 13	Fri	9.1,3	Viscous Flow in Closed Conduit: Steady Laminar Flow, Plates and Smooth Pipe	19
-	*Mar 16*	*Mon*	-	*Spring Break-No Class*	-
-	*Mar 18*	*Wed*	-	*Spring Break-No Class*	-
-	*Mar 20*	*Fri*	-	*Spring Break-No Class*	-
25	Mar 23	Mon	9.5-6	Viscous Flow in Closed Conduit: The Reynolds Number	20
26	Mar 25	Wed	9.7-8	Viscous Flow in Closed Conduit: Shear Stress and Turbulent Flow in Pipe	21
-	*Mar 27*	*Fri*	-	*Cesar Chavez Holiday–no classes*	-
27	Mar 30	Mon	10.1	Pipe Flow: Rough Pipes and The Moody Diagram	22
28	Apr 01	Wed	10.2-3	Pipe Flow: Losses in Fittings and Transitions	23
29	Apr 03	Fri	10.4-5	Pipe Flow: Pipe Systems and Flow Measurement	24
30	Apr 06	Mon	-	Exam 3 Review	-
31	**Apr 08**	**Wed**	**8-10**	**EXAM 3**	**17-24**
-	*Apr 10*	*Fri*	-	*Spring Study Day - no classes*	-
32	Apr 13	Mon	11.1-2	Viscous Flow over External Surfaces: Laminar Boundary Layers	25
33	Apr 15	Wed	11.4-5	Viscous Flow over External Surfaces: Turbulent Boundary Layers	26
34	Apr 17	Fri	11.6-11	Viscous Flow over External Surfaces: Drag and Lift	27
35	Apr 20	Mon	12.1-3	Open-Channel Flow: Specific Energy	28
36	Apr 22	Wed	12.4-5	Open-Channel Flow: Rises and Sluice Gates	29
37	Apr 24	Fri	12.6	Open-Channel Flow: Steady Uniform Flow (Chezy and Manning Equations)	30
38	Apr 27	Mon	12.8-9	Open-Channel Flow: Hydraulic Jumps and Weirs	31
39	Apr 29	Wed	14.1-5	Turbomachines: Pumps and Turbines	32
40	May 01	Fri	14.6-9	Turbomachines: Pump Performance, NPSH, Selection, and Similitude	33
41	May 04	Mon	13.1-3	Compressible Flow: The Mach Number	34
42	May 06	Wed	-	Exam 4 Review	-
43	**May 08**	**Fri**	**11-12,14**	**EXAM 4**	**25-34**
44	**May 11**	**Mon**	**1-6,8-14**	**FINAL EXAM: 10:00am - 12:45pm (Comprehensive)**	**1-34**