University of Texas at Tyler - Department of Civil Engineering
CENG 3310 Fluid Mechanics and Hydraulics
Fall 2021

Instructor: *Section 001 (Tyler Campus)*

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Office Hours:
M/W/F: 9AM - 10AM
THURS: 2PM – 3:30PM
or by appointment

Lecture:
Monday/Wednesday/Friday: 8:00 AM-8:55 AM, RBN 3040

Course Website:
Canvas will be used to manage the course material for the semester. There you will find homework assignments, homework solutions, handouts and other material pertaining to the class. **Please check there regularly.**

Catalog Description:
Basic concepts of a fluid and the fundamentals/applications of ideal/real flow. Topics: fluid statics, conservation principles, Bernoulli, pipe flow, pump/turbines, momentum, drag, similitude, open channel flow.

Learning Objectives:
1. Determine pressures and forces on submerged bodies.
2. Analyze flow rates, velocities, energy losses, and momentum for fluid systems.
3. Apply the laws of conservation of mass, momentum, and energy to static fluids and general fluid flow in conduits or open channels.
4. Analyze fluid flow in pipeline components.

Prerequisites:
ENGR 2302: Engineering Dynamics; MATH 3305: Ordinary Differential Equations

Co-requisite:
MATH 3404: Multivariable Calculus

Required Text:
Any fluid mechanics textbook

Recommended Text (the one in which I reference in class):
Fundamentals of Fluid Mechanics, 8th Edition, by Munson, Young, Okilshi, Gerhart, Gerhart and Hochstein, Wiley Publishing, ISBN: 978-1-118-84713-8

Course Schedule (Subject to Change):

COURSE SCHEDULE - SUBJECT TO REVISION					
CENG 3310 Fall 2021 (MWF 8:00 am - 8:55 am)					
Lesson No.	**Date**	**Topic**	**Lesson Material**	**Homework Assigned**	**Assignment Due**
		Week 1			
1	8/23	Course Introduction, Fluid Properties	1.1-1.4	HW1 Assigned	
2	8/25	Ideal Gas Law, Viscosity	1.5-1.6	HW2 Assigned	
3	8/27	Viscosity, compressibility, hydrostatic pressure	1.6-1.7.1, 2.1-2.3		HW1 Due
		Week 2			
4	8/30	Hydrostatic Pressure derivation and Examples	2.3.1	HW3 Assigned	HW2 Due
5	9/1	Barometers, Manometers (Pieozometers and U-Tube Manometers)	2.4-2.6	HW4 Assigned	
	9/3	**CENSUS DATE**			
6	9/3	U-Tube Manometer Example, Hydrostatic forces on plane surfaces	2.6, 2.8		HW3 Due
		Week 3			
	9/6	**LABOR DAY**			
7	9/8	Hydrostatic forces on plane surfaces, Pressure prisims	2.8-2.9	HW5 Assigned	HW4 Due
8	9/10	Hydrostatic forces on curved surfaces	2.10	HW6 Assigned	
		Week 4			
9	9/13	Buoyancy and Stability	2.11	HW7 Assigned	HW5 Due
10	9/15	Conservation of Mass, Continuity Equation	2.10-2.11, 5.1	HW8 Assigned	HW6 Due
11	9/17	Bernoulli Equation	5.1, 6.4.2		HW7 Due
		Week 5			
12	9/20	**EXAM 1**			
13	9/22	Energy Equation (Examples)	3.3-3.6	HW9 Assigned	HW8 Due
14	9/24	Hydraulic Grade Lines and Energy Lines	3.7	HW10 Assigned	
		Week 6			
15	9/27	Laminar Flow in Pipes	8.1-8.2	HW11 Assigned	HW9 Due
16	9/29	Turbulent Flow Pipes	8.4		HW10 Due
17	10/1	Turbulent flow pipes (examples cont), conduit flow, minor losses	8.4.2 and 8.4.3	HW12 Assigned	
		Week 7			
18	10/4	Minor Losses, Pipe flow problems	8.4.2		HW11 Due
19	10/6	Pipe flow problems (con't), Itteration to solve V, Q, and D	8.4.3, 8.5.2	HW13 Assigned	
20	10/8	Iteration to solve V, Q and D, HGL and EGL	8.5.2	HW14 Assigned (Not Collected)	HW12 Due
		Week 8			
21	10/11	3 Reservoirs Problem	8.5.2	HW15 Assigned	HW13 Due
22	10/13	Calculating pump head, Pitot tubes	5.3.3, 3.5	HW16 Assigned	
23	10/15	Hazen-Williams Equation, Pipes in Parallel	8.5.2	HW17 Assigned	HW15 Due
		Week 9			
24	10/18	Flow meters, Momentum (intro)	8.6, 5.2		HW16 Due
25	10/20	Momentum	5.2	HW18 Assigned	HW17 Due
26	10/22	Momentum	5.2		
		Week 10			
27	10/25	Dimensional Analysis: Intro and Inspection methods	7.1-7.3, 7.5	HW19 Assigned	HW 18 Due
28	10/27	Dimensional Analysis: Linear Equations	7.3		
29	10/29	Dimensional Analysis: Data correlation	7.7	HW20 Assigned	
		Week 11			
30	11/1	**EXAM 2**			
	11/1	**LAST DAY TO WITHDRAW FROM ONE OR MORE COURSES**			
31	11/3	Similitude	7.8, 7.6	HW21 Assigned	HW19 Due
32	11/5	Similitude	7.8, 7.6, 9.1-9.3		HW20 Due
		Week 12			
33	11/8	Drag	9.1-9.3	HW22 Assigned	HW21 Due
34	11/10	Drag and Lift	9.3-9.4		
35	11/12	General open channel flow, surface waves	10.1-10.2	HW23 Assigned	HW22 Due
		Week 13			
36	11/15	Specific Energy	10.3	HW24 Assigned	
37	11/17	Manning Equation	10.4	HW 25 Assigned	HW23 Due
38	11/19	**EXAM 3**			
		THANKSGIVING BREAK (11/22 - 11/27)			
		Week 14			
39	11/29	Manning Equation Examples, Hydraulic Jumps	10.4		HW 24 Due
40	12/1	Hydraulic Jumps and Weirs	10.4-10.6	HW26 Assigned (Not Collected)	HW25 Due
41	12/3	Final Exam Review			
	12/6	**Dead Day**			
	12/8	**Final Exam**			

Exams:

There will be 3 midterm examinations and one final examination. The exams are **TENITATIVELY** scheduled for:

Exam 1: September 20th
Exam 2: November 1st
Exam 3: November 19th
Final Exam: December 8th

Exams dates may be moved up or pushed back depending on the progress of the lectures. Exams are closed book. You can use a calculator and instructor approved reference material. *Solutions to exams will NOT be posted on Canvas*. No make-up exams will be given except for medical or other similar hardships where advanced arrangements are made with the instructor; or in case of non-selective medical emergencies with appropriate physician's note or documentation. Other than circumstances described above, failure to take the exam at the scheduled time will constitute a grade of zero in the exam. **ALL EXAMS WILL BE HELD IN PERSON DURING CLASS TIME. THE FINAL EXAM WILL ALSO BE HELD IN PERSON AT THE TIME, DATE AND LOCATION SPECIFIED BY THE UNIVERSITY.**

Homework:
Homework will be assigned on a regular basis (see homework schedule). Homework is due on the date outlined in the schedule. **You will need to upload your homework as a single pdf file to canvas no later than 8 am on the date it is due.** No late homework will be accepted except for unusual circumstances. Homework will not be graded in the traditional sense. You will find that all homework solutions are posted on Canvas so you will be able to check your own work before submitting the assignment. You will be given full credit for submitting your homework on time and following the correct homework format. Homework that is not submitted as **complete** and following the homework guidelines will receive a 0. No partial credit is awarded on homework, it is 100% or 0. **Homework must be submitted on engineering paper**. Solutions should be presented in a clear methodical manner. Follow the "homework submission guidelines" when completing your assignment. Solutions which are not clearly presented will **NOT** receive credit.

Homework Submission Guidelines (Professionalism Requirements):
1. Homework should be submitted using letter size (8 ½ x 11") paper. Engineering paper is required.
2. The header of the first page should include the following:
    a. Name of Student
    b. Student Number
    c. Course Number and Name
    d. Homework Number
3. There should be no more than 2 problems per page. This is to ensure that there is enough space on the paper for the grader to add comments.
4. Multiple sheets should be stapled at the top left corner of the page.
5. The submitted papers should be free of frail edges, stains, smudges and wrinkles.
6. All problems should include:
    a. Problem Number
    b. A diagram of the problem (draw all free body diagrams when necessary)
    c. A set of given quantities
    d. A set of unknown quantities
    e. A set of assumptions
7. All numbers and writing should be clear and readable.
8. When required to produce a graph, use a computer program such as excel or matlab to generate the plot. Do not draw it by hand!

9. The **final answer should be boxed** and at the end of the solution.

Grades:	**Grade Scale:**
Homework/Quizzes = 15%	A: 90-100
Professional Practice =10%	B: 80-89
Midterm Exams (3) = 50%	C: 70-79
Final Exam = 25%	D: 60-69
	F: <60

If necessary, I reserve the right to adjust the grade scale at the end of the semester to your benefit.
If you earn less than 65% on all Exams or if you fail to earn at least 50% on the Final you may fail the course, **regardless of your course grade**.

****NOTE:** There will be no makeup work or extra credit allowed/granted at the end of or during the semester unless allowed/granted to everyone by the instructor. All assignments must be turned in at the appropriate time to receive credit.

Quizzes:
The instructor may give unannounced in-class or take home quizzes throughout the semester.

Professional Practice:
Your professional practice grade will be broken down into two components. (1) 5% of the 10% percentage points will be based on your attendance at **3 ASCE or ASME student technical meetings** (cookout and game night events do not count) throughout the fall semester. Example of valid meetings include guest speakers, field trips, or any other technical meeting from either organization within the college of engineering. (2) the remaining 5 percentage points is based on your participation in class. You are expected to attend and actively patriciate in all activities of the course. Non-attendance may adversely affect your grade. If your absence from class becomes excessive you may be asked by the instructor to withdraw from the class.

Laptops/PDAs/MP3 players/Cell Phones or other electronic devices:

- The use of any electronic device, except an approved calculator, is not permitted during exams. Your exam will be collected and your grade will be a zero if you are caught using a non-approved electronic device/calculators. Any instances of a calculator inappropriately used during an exam will be the basis of alleging Academic Misconduct and may result in Failing (F) of the course at the determination of the course's instructor or the basis for a recommendation for expulsion from the University. Any Calculator used during an exam in this course must meet the requirements stated within the policy below.

Calculator Policy:
Only NCEES approved calculators will be permitted during tests and your test will be collected and your grade will be a zero if you are using a non-approved calculator.

The approved calculators include the following: (Please check the NCEES website for a complete listing, www.ncees.org/exams/calculator-policy/. Examples include but are not limited to:

- Hewlett Packard – HP 33s, HP 35s, and no others
- Casio – All FX 115 models
- Texas Instruments – All TI 30X or TI-36X models.
- If you are unsure about your calculator, it is your responsibility to check with the instructor for approval.

At the discretion of the course instructor, any calculator not meeting the requirements stated (especially in the case of a graphing calculator) may be used but only after an inspection of the device and a clearing of all the memory within the device, performed for the instructor at a time immediately prior to the exam. At any time during the exam your calculator is subject to a random search by the instructor. Failure or refusal to clear all memory or to surrender your calculator to search will disqualify you from the exam immediately, unless you can produce a calculator meeting the requirements as stated above.

Final day to withdraw:
The final day to withdraw from the course without penalty is **November 1st**

Census dates:
The university requires that instructors to report the attendance to the register at various points in the semester. Therefore, on **September 3rd** I will report the attendance for the class.

UT Tyler Honor Code: Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Recording of Class Sessions: Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.

Academic Misconduct: Plagiarism of homework and cheating on examinations will be interpreted as academic misconduct and will not be tolerated. Please refer to the University of Texas at Tyler current Undergraduate Catalog for academic policies and Manual of Policies and Procedures for Student Affairs (MOPPS, Chapter 8) regarding academic integrity, cheating and plagiarism. Academic dishonesty will not be tolerated. Ignorance of the rules and policies provides no protection from the consequences.

Collection of Student Work:
Throughout the semester I will collect student work (best, average, and worst) for the ABET outcomes notebooks. This will require me to make a copy of your work, keep your original and

return a copy of the graded work to you. I will not draw attention as to what level of work you accomplished.

Students Rights and Responsibilities: To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link:
http://www.uttyler.edu/wellness/StudentRightsandResponsibilities.php

Grade Replacement/Forgiveness and Census Date Polices: Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions that students need to be aware of. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy: Texas law prohibits a student who began college for the first time in fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).
Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability/Accessibility Services: In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Tyler at Texas offers accommodations to students with learning, physical and/or

psychological disabilities. If you have a disability, including non-visible a diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance: Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities: If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Social Security and FERPA Statement: It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation: Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services

Student Standards of Academic Conduct: Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:
   - copying from another student's test paper;
   - using, during a test, materials not authorized by the person giving the test;
   - failure to comply with instructions given by the person administering the test;
   - possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
   - using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;

- collaborating with or seeking aid from another student during a test or other assignment without authority;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
- paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;
- taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
- misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by SafeAssignTM, available on Blackboard. UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)

UT Tyler a Tobacco-Free University: All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

Campus Carry: We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

Prepared by: Michael V. Gangone, Ph.D.
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Assignment Schedule:

HOMEWORK SCHEDULE - SUBJECT TO REVISION

CENG 3310 Fall 2021

Homework No.	Topic	Homework Assigned	Assignment Due
1	Dimensions and Fluid Properties	August 23, 2021	August 27, 2021
2	Ideal Gas Law, Viscosity and Compressibility	August 25, 2021	August 30, 2021
3	Hydrostatic Fluid Pressure	August 30, 2021	September 3, 2021
4	Gage vs. Absolute Pressure and U-Tube Manometers	September 1, 2021	September 8, 2021
5	Hydrostatic Force on Planar Surfaces	September 8, 2021	September 13, 2021
6	Hydrostatic Forces on Curved Surfaces	September 10, 2021	September 15, 2021
7	Buoyancy	September 13, 2021	September 17, 2021
8	Continuity Equation - Mass and Volumetric Flow Rates	September 15, 2021	September 22, 2021
9	Pipe Flow - Bernoulli Equation	September 22, 2021	September 27, 2021
10	Pipe Flow - HGL and EGL (no head loss)	September 24, 2021	September 29, 2021
11	Pipe Flow - Major Head Loss	September 27, 2021	October 4, 2021
12	Pipe Flow - Minor Losses	October 1, 2021	October 8, 2021
13	Pipe Flow - Iteration	October 6, 2021	October 11, 2021
14	Pipe Flow - HGL and EGL (with head loss)	October 8, 2021	NOT COLLECTED
15	Pipe Flow - Three Reservoir Problem	October 11, 2021	October 15, 2021
16	Pipe Flow with Pumps	October 13, 2021	October 18, 2021
17	Hazen Williams Equation	October 15, 2021	October 20, 2021
18	Conservation of Momentum	October 20, 2021	October 25, 2021
19	Dimensional Analysis	October 25, 2021	November 3, 2021
20	Dimensional Analysis Model Flitting	October 29, 2021	November 5, 2021
21	Similitude	November 3, 2021	November 8, 2021
22	Drag and Lift	November 8, 2021	November 12, 2021
23	Open Channel Flow - Wave Speed	November 12, 2021	November 17, 2021
24	Open Channel Flow - Specific Energy	November 15, 2021	November 29, 2021
25	Open Channel Flow - Manning Equation	November 17, 2021	December 1, 2021
26	Open Channel Flow - Hydraulic Jumps and Weirs	December 1, 2021	NOT COLLECTED

Exam	Content	Date
Exam 1	Lessons 1-9, Homework 1-7	9/20/2021
Exam 2	Lessons 10-26, Homework 8-18	11/1/2021
Exam 3	Lessons 27-35, Homework 19-23	11/19/2021
Final Exam	Comprehensive	12/8/2021