

CE3105 Mechanics of Fluids Laboratory – FALL 2021
Department of Civil Engineering
Texas Tech University

BASIC REQUIREMENTS FOR THIS LAB:

- i. **Laptop:** A laptop that meets the laptop requirements of the Whitacre College of Engineering found at <https://www.depts.ttu.edu/coe/dean/engineeringitservices/buyingtherightcomputer.php>
- ii. Students might have access to online meeting software such as ZOOM, Microsoft Teams, Blackboard Collaborate Ultra or others to work on laboratory reports.

b. **Make Up Policy on absences resulting from illness:**

General Note: If a student misses two Labs that is 25% of this course. There simply will not be sufficient time to catch back up.

As quizzes are of 15 minute duration and students are provided time as shown on the calendar. An absence from the quiz would require the doctor's note to cover the entire time over which the quiz.

If the student is unable to attend the lab section due to illness, you will need a doctor's note stating that you were unfit to attend the lab on the day of your section, but are medically cleared to attend on another day.

If you unable to make up the lab on the same week as you are not not medically cleared for the week or there is no other section available for makeup (say you are in Friday section) or because you have class conflicts with other sections of the lab, then the average grade for all labs will be used as a makeup grade. Please note that you need to provide evidence of the absence and class conflicts. Please note that no exceptions will be made for conflicts arising from other than class schedules.

- c. **Requesting accommodations as a result of personal health concerns.** Keep in mind the instructor must review the following criteria when considering an accommodation for a student: (1) whether the requested accommodation would make a substantive alteration of the course material or objectives; (2) whether the accommodation provides an equally effective alternative to the original objectives or activities of the class; and (3) whether the accommodation can be uniformly applied should more than one student request it. If the instructor can satisfactorily address these three requirements for accommodation, and is comfortable providing it, then it is appropriate to do so. If the instructor (IoR) feels unable to provide accommodation that satisfies these three criteria or is unsure how the requested accommodation can be provided, the IoR might suggest that the student work with SDS to provide a Letter of Accommodation (LOA).

- d. **Recorded lectures.** lectures may be recorded. However there is no expectation to provide recordings of inclass lectures as students are expected to be in class. Be aware that the video recording may include partial or full view of students in the class along with audio if a question is asked. The recording equipment is set up to capture the professor and their computer setup so anything in that vicinity will appear in the recording.
- e. **Important dates:**
- **See calendar and schedule table for this Summer session**
 - **Wednesday July 6th** – First Day of classes
 - **Thursday August 4th** – Last Day of classes
 - **NO FINAL Exam**

Schedule: Section 301 09:00 pm - 11:50 am Monday
Section 303 12:00 pm - 02:50 pm Monday
Section 304 03:00 pm - 05:50 pm Friday

Location: Room **CE0007** will be used for lecture and lab waiting area. **Room CE178** is where experiments will be performed.

Instructor : Don Bundock (806)543-3353

Email: Don.Bundock@ttu.edu

Office: **CECE 215B – Murdough Center**

Office Hours: By appointment in my TTU office or also ONLINE

- Don Bundock:
 - Please text message or email for an office appointment. I can also meet you on **ZOOM, Microsoft Teams, or Collaborate Ultra.**

Required Textbook: **None.** Lab handouts will be posted on Blackboard.

Required Software: Students need to have Word and Excel or equivalent. Adobe PDF reader is also required to open lecture notes and **digitally fill out and sign effort sheets.** **“QR” scanning capability is required for this course!**

Optional Textbook: Fluid Mechanics with Engineering Applications, Franzini & Finnemore, 10th Ed., 2002 or any other equivalent textbook

Prerequisite: CE3305 Mechanics of Fluids

Course Objectives

The students will be exposed to the experimental method and will be able to:

1. Make measurements of fluid properties and flow phenomena,
2. Apply the fundamental principles of hydrostatics and conservation of mass, energy, and momentum to a control volume,
3. Write a report on the experiment and discuss the experimental observations in the context of theory.

Course Description

CE3105 is the laboratory course in fluids and flow phenomena and is closely linked to the lecture course. It is intended to draw to student's attention the behavior of real fluids and to expose students to the experimental method. The class will also improve technical writing skills and prepare students for the fluid mechanics section of the FE Exam. This course emphasizes collaboration through group work, and as such, a portion of the course grade will be based upon peer assessment.

Course Assessment

1. Class attendance is required.
2. **Quizzes will be on the Blackboard.**
3. Lab groups must perform their experiment during their assigned period.
4. Each group will submit one report by the designated deadline with independent data analysis and discussion. All members of the group must contribute equally to the report.
5. **LATE REPORTS WILL NOT BE ACCEPTED.**
6. Reports must be **TYPED**. No handwritten reports will be accepted.
7. Students have 1 week after the return of reports to dispute their grade. After 7 days, scores are closed for discussion.

Class participation

During class, students will be asked questions and are expected to participate in a meaningful manner.

Grading

Laboratory Reports (**65%**), Team Effort sheet (**5%**) and quizzes (**30%**)

Attendance is mandatory. You are required to attend the section you are signed up for. Students will not be allowed make up for missed labs without obtaining the approval of the instructor. Please obtain the approval from the instructor beforehand if you are going to be on an university excused absence. Please let the instructor know, as soon as possible, if you are unable to make it to your section due to health reasons. You will be required to submit a doctor's note that authenticates your inability to attend classes on the day of your lab due to your medical condition. Many labs are setup and conducted using the same stations. As such, it may not be possible to hold the experimental setup the following week. Therefore, it is important to notify the instructors of your absences as quickly as possible.

Please note that the only exceptions are documented illness and university excused absence. There will be no other exceptions. If you are unable to make up a lab during the week due to – 1) Documented illness where a doctor has ruled out your attendance for the times when other sections are held or 2) You have scheduling conflicts due to other classes during the times of the week when other sections of CE 3105 meet, then upon verification of the proof presented, the instructor may choose to assign an average grade of your other labs to the missing lab report. Please note that there will no exceptions made for other events that are not university excused or pertain to class conflicts (e.g., outside work, job interviews, etc.)

A student missing a lab experiment without a valid excuse (documented illness or

university excused absence) will receive a grade of zero for that lab.

Grading Scale A: 90-100% B: 80-89% C: 70-79% D: <70%

Lab Reports (65%):

Laboratory reports will be graded out of 100 points (see lab report rubric attached). The lab reports will count towards 65% of your overall grade. All members of the group will get the same grade for their submitted lab report. Students missing labs will automatically receive a zero on their lab report. Students are strongly encouraged to use **spreadsheets** to automate their calculations and make charts but are required to show at least one set of calculations by hand.

Team Effort Sheet (5%)

Documentation of time and effort is an important part of civil engineering practice. As part of the lab report submission, each team will fill out a peer-assessment sheet indicating efforts of all the team members for that particular lab. The peer-evaluation will constitute 5% of your grade. Therefore, each student will receive an individual grade based upon both their work as a group, and their classmates' assessment of their contribution to the final product. Students missing labs will automatically receive a zero on their team effort sheet.

Quizzes (30%):

The purpose the quiz is to help reinforce concepts presented in CE 3305 Mechanics of Fluids and CE 3105 Mechanics of Fluids Laboratory. All quizzes will be conducted online using the blackboard content management system. Quizzes will be posted and available on **BLACKBOARD per the Calendar Schedule**. The official time for each quiz is 15 minutes. However, students are being given longer time to give them flexibility with scheduling their quiz and also the electronic technology is being exploited to allow students more than one attempt. Students can take quizzes even if they are not in attendance of the lab. **There will be no makeup quizzes**. If a student provides a valid excuse (university related absence or documented medical absence) for the entire duration over which the quiz was open, then the student will be given an average grade of all other quizzes for the quiz in question. This exception does not apply if the student's absence is covered only for a portion of time the quiz was open.

Once the quiz is closed it will not be opened up for any reason. Each Quiz will generally take no more than 15 minutes so there is ample time provided to complete them. Students are given at least two attempts for each question of the quiz. **It is important that students hit the SUBMIT button to ensure the quiz is recorded in the system. Failure to do so will result in quiz grades not being rolled into the BLACKBOARD system and will affect the student's grade.**

LABORATORY SAFETY - CERTIFICATION REQUIRED AT START OF COURSE

Students must adhere to safety procedures and protocols and follow the instructions provided by the Lab Instructors at all times. Students should also wear proper attire to the labs (e.g., close toe shoes, full pants).

All students must complete the safety training prior to working in the lab. The training can be accessed at - <https://www.depts.ttu.edu/ehs/Training>. The students must print

their certificate of completion and present it to the instructor and upload it onto **BLACKBOARD**.

Required:

Scientific calculator (Must be on the list approved by Civil Engineering Department as mentioned below.)

Calculators:

Only NCEES approved calculators will be permitted during tests, otherwise your test will be collected and your grade will be a zero if you are caught using a non-approved calculator. The approved calculators include the following:

- Hewlett Packard - HP 30s, HP 33s, HP 9s
- Casio - FX 115 ES, FX 115 MS, and FX 115 MS Plus (Note: FX 115 ES and FX 115 MS models ending with an "-SR" designation are also allowed.)
- Texas Instruments - TI 30XA (or TI 30Xa), TI 30X IIS and TI 30X IIB, TI 36X Solar
- If you are unsure about your calculator, it is your responsibility to check with the instructor for approval.

Laptops/PDAs/MP3 Players/Cell Phones/ etc.:

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. The use of phones and MP3 players is not permitted during lessons.

Specific Course Objectives

Each student at the end of the course should be able to perform the following tasks:

1. Utilize the fluid properties with the right units to solve fluid problems.
2. Solve manometer problems through application of fundamental equation of fluid statics.
3. Determine the pressures, and forces and their line of action, for a fluid at rest on plane and curved surfaces.
4. Identify a control volume.
5. Be able to apply the conservation of mass principle to a control volume.
6. Be able to apply the conservation of energy principle to a control volume.
7. Be able to apply the conservation of momentum principle to a control volume.
8. Solve channel transitions (width/bed level changes) in open channel flow problems.
9. Observe the difference between the behavior of a real and a theoretical fluid.

Experiments (tentative)

1. Fluid Properties
2. Forces on Plane Surfaces/ Archimedes' Principle
3. Flow Measurement Apparatus
4. Friction Loss in Pipe
5. Pipework Energy Losses
6. Impact of Jet
7. Two-Stage Centrifugal Pump Test
8. Stage Discharge Curves / Manning's Roughness Coefficient Determination

The instructor and the TAs reserve the right to change the above outline depending upon their assessment of the class performance and due to changes in the subject material and other extenuating factors. The changes are not limited to the content and coverage but also

include deadlines for homeworks, assignments, project reports and in-term exams.

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Tentative Schedule:

1. All Quizzes will be due per the schedule presented in the **TABLE** below. See the deadlines for quizzes in the Table below. Please do not wait till the last minute to avoid any potential internet issues.
2. Lab reports will be due per the schedule presented in the **TABLE** below. You need to submit (upload) the lab report on or before the beginning of your class time for your section during the deadline week shown. The upload time-stamp will be used to evaluate the timely submission of the report.

Date	Activity	Deadline of the reports	Deadline of the quizzes
Aug 23 rd – Aug 27 th	No LABS First Week	-	-
Aug 30 th - Sep 3 rd	Introduction / LAB safety Online Lecture	TEAMS MEET	-
Sep 6 th – Sep 10 th	LABOR DAY – NO LABS		
Sep 13 th – Sep 17 th	Experiment 1: Fluid Properties	Report 1: Sep 20 th – Sep 24 th	Quiz 1: Sep 17 th
Sep 20 th – Sep 24 th	NO LABS - JOB FAIR	JOB INTERVIEWS	JOB INTERVIEWS
Sep 27 th – Oct 1 st	Experiment 2: Forces on Plane Surfaces/ Archimedes' Principle	Report 2: Oct 4 th – Oct 8 th	Quiz 2: Sep 24 th
Oct 4 th – Oct 8 th	Experiment 3: Flow Measurements	Report 3: Oct 11 th – Oct 15 th	Quiz 3: Oct 8 th
Oct 11 th – Oct 15 th	Experiment 4: Major Loss in a Pipe	Report 4: Oct 18 th – Oct 22 nd	Quiz 4: Oct 15 th
Oct 18 th – Oct 22 nd	Experiment 5: Energy Losses in a Pipe	Report 5: Oct 25 th – Oct 29 th	Quiz 5: Oct 29 th
Oct 25 th – Oct 29 th	Experiment 7: Two Stage Centrifugal Pump	Report 7: Nov 1 st – Nov 5 th	- Quiz 7: Nov 19 th
Nov 1 st – Nov 5 th	Experiment 6: Impact of Jet	Report 6: Nov 8 th – Nov 12 th	Quiz 6: Nov 5 th
Nov 8 th – Nov 12 th	Experiment 8: Manning's Roughness Coefficient	Report 8: Nov 15 th – Nov 19 th	Quiz 8: Nov 29 th
Nov 15 th – Nov 19 th	No Labs		
Nov 22 nd – Nov 26 th	THANKSGIVING		
Nov 29 th – Dec 3 rd	No Labs		

The instructor reserves the right to change the schedule.

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Report Format

Page 1. - Cover page (3 points)

Contains title of report, authors of report, dates of report (date of submission & date of experiment), and name of report recipient (Course Instructor). Also please include your course section number.

Page 2. – Table of Contents (5 points)

Contains the contents of the report including a list of figures and a list of tables.

Page 3. - Theory page (22 points)

Background - Contains a derivation of the theory/equation behind the experiment. Typically, it will involve application of the Continuity, Energy and/or Momentum Equations to a specific control volume and will result in either an equation for flow rate, pressure change or applied force that will be measured in the experiment. Describe any equations used to perform the analysis of the experiment.

Page 4. - Apparatus page (5 points)

Contain a sketch of the apparatus and a list of the variables used/measured in the experiment (with units).

Page 5. - Results page (20 points)

Contains graphs and tables of interpreted results. Results will involve a comparison between measured (from experiment) and predicted (from theory) results. Briefly explain your results. Label graphs and tables per ASCE format. ***Do not show a graph or a table without an explanation.***

Page 6. - Discussion page/s (20 points)

Contains a discussion of the results and should comprise;

1. A comment on whether the purpose of the experiment was met, and if not, why not.
2. Answer specific questions in the Interpretation Section of the Experiment Instructions.
3. A discussion on where discrepancies and sources of error might arise.
4. A real life application of this apparatus/experiment.

Page 7. - Data Appendix (5 points)

Contains the original data sheets for the experiment (Completely filled out).

Page 8. Error Analysis Calculations (10 points)

Contains a sample calculation of error analysis for **one** lab trial. A table of calculated error analysis values for all trials will be included in the error analysis section.

Page 9. Sample Calculations (10 points)

Contains a sample of your calculations, but not all repetitive calculations. Every equation used in a calculation needs to have a sample shown.

Effort Sheet (5% of the overall Laboratory Grade) Template.

Student Name	Tasks Performed	Remarks

We attest that the tasks outlined in the above table represent an accurate depiction of the work performed by the group members. Use the remarks column to add any comments (e.g., timeliness) or note any disagreements.

Signatures: (Must be signed by all group members)

Name: _____ Signature _____

Name: _____ Signature _____

Name: _____ Signature _____

Name: _____ Signature _____

Name: _____ Signature _____

Date: _____

Students will use the fillable pdf for online submissions.

INSTITUTIONALLY REQUIRED INFORMATION

ADA STATEMENT:

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in West Hall or call 806-742-2405.

ACADEMIC INTEGRITY STATEMENT:

Academic integrity is taking responsibility for one's own class and/or course work, being individually accountable, and demonstrating intellectual honesty and ethical behavior. Academic integrity is a personal choice to abide by the standards of intellectual honesty and responsibility. Because education is a shared effort to achieve learning through the exchange of ideas, students, faculty, and staff have the collective responsibility to build mutual trust and respect. Ethical behavior and independent thought are essential for the highest level of academic achievement, which then must be measured. Academic achievement includes scholarship, teaching, and learning, all of which are shared endeavors. Grades are a device used to quantify the successful accumulation of knowledge through learning. Adhering to the standards of academic integrity ensures grades are earned honestly. Academic integrity is the foundation upon which students, faculty, and staff build their educational and professional careers. [Texas Tech University ("University") Quality Enhancement Plan, Academic Integrity Task Force, 2010]

RELIGIOUS HOLY DAY STATEMENT:

"Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. A student who is excused under section 2 may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.

DISCRIMINATION, HARASSMENT, AND SEXUAL VIOLENCE STATEMENT:

Texas Tech University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from gender and/or sex discrimination of any kind. Sexual assault, discrimination, harassment, and other Title IX violations are not tolerated by the University. Report any incidents to the Office for Student Rights & Resolution, (806)-742-SAFE (7233) or file a report online at titleix.ttu.edu/students. Faculty and staff members at TTU are committed to connecting you to resources on campus. Some of these available resources are: TTU Student Counseling Center, 806- 742-3674, <https://www.depts.ttu.edu/scc/> (Provides confidential

support on campus.) TTU 24-hour Crisis Helpline, 806-742-5555, (Assists students who are experiencing a mental health or interpersonal violence crisis. If you call the helpline, you will speak with a mental health counselor.) Voice of Hope Lubbock Rape Crisis Center, 806-763-7273, voiceofhopelubbock.org (24-hour hotline that provides support for survivors of sexual violence.) The Risk, Intervention, Safety and Education (RISE) Office, 806-742-2110, <https://www.depts.ttu.edu/rise/> (Provides a range of resources and support options focused on prevention education and student wellness.) Texas Tech Police Department, 806-742-3931, <http://www.depts.ttu.edu/ttpd/> (To report criminal activity that occurs on or near Texas Tech campus.)

CIVILITY IN THE CLASSROOM STATEMENT:

Texas Tech University is a community of faculty, students, and staff that enjoys an expectation of cooperation, professionalism, and civility during the conduct of all forms of university business, including the conduct of student–student and student–faculty interactions in and out of the classroom. Further, the classroom is a setting in which an exchange of ideas and creative thinking should be encouraged and where intellectual growth and development are fostered. Students who disrupt this classroom mission by rude, sarcastic, threatening, abusive or obscene language and/or behavior will be subject to appropriate sanctions according to university policy. Likewise, faculty members are expected to maintain the highest standards of professionalism in all interactions with all constituents of the university.

To ensure that you are fully engaged in class discussions and account team meetings during class time, you are expected to do the following:

- ✓ Maintain the same level of civility and professionalism that would be expected in a face-to-face classroom setting.
- ✓ Attend all classes regularly.
- ✓ Log into the video conference on time and remain logged in for the duration of the classperiod.
- ✓ Activate your camera so that you are visible to the instructor and other students in the class. If you have concerns about leaving your camera on (such as childcare obligations, privacy issues, or a particular circumstance during a class period), please talk to the instructor.
- ✓ Refrain from engaging in non-class related activities during class time that create a distraction for other students in the class and/or limit your ability to engage in the course.

Failure to meet these expectations may result in the following consequences:

1. Being counted as absent for the class meeting.
2. Not receiving credit for class participation for that class period.
3. Other consequences as stipulated in the syllabus, *Texas Tech Code of Student Conduct*, or other university policy.

LGBTQIA SUPPORT STATEMENT:

Office of LGBTQIA, Student Union Building Room 201, www.lgbtqia.ttu.edu, 806.742.5433 within the Center for Campus Life, the Office serves the Texas Tech community through facilitation and leadership of programming and advocacy efforts. This work is aimed at

strengthening the lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) community and sustaining an inclusive campus that welcomes people of all sexual orientations, gender identities, and gender expressions.

INTRO TO ACCREDITATION BOARD ENGINEERING AND TECHNOLOGY (ABET)

ABET is a nonprofit, non-governmental accrediting agency for programs in applied and natural science, computing, engineering and engineering technology and ABET is recognized as an accreditor by the Council for Higher Education Accreditation.

To date, over 3,700 programs at more than 750 colleges and universities in 30 countries have received ABET accreditation. Approximately 85,000 students graduate from ABET-accredited programs each year, and millions of graduates have received degrees from ABET-accredited programs since 1932.

Why ABET Accreditation?

It ensures that graduates have met the educational requirements necessary to enter the profession. It provides opportunities for the industry to guide the educational process to reflect current and future needs. It enhances the mobility of professionals

What Accreditation Means?

1. Students

Be confident in your education—ABET accreditation is the trusted standard for employers worldwide.

2. Programs & Institutions

ABET accreditation demonstrates your commitment to delivering quality education.

3. Industry, Government & the World

Employers can trust that graduates of ABET-accredited programs are prepared to enter the workforce and make a positive contribution to the global society

Why assess student performance in courses?

To be an ABET accredited, the program must regularly use appropriate, documented processes for assessing and evaluating the extent to which the ABET student outcomes are being attained. The results of these evaluations must be systematically utilized as input for continuously improving the program. Evidence of achieving those outcomes are based on employers comments, senior exit surveys, industry assessment, and course performance

ABET Student Outcomes

Student outcomes are items that should be *learned by the end of the class* and are selected on a *per course basis*.

- a) an ability to apply knowledge of mathematics, science, and engineering

- b) an ability to design and conduct experiments, as well as to analyze and interpret data
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d) an ability to function on multidisciplinary teams
- e) an ability to identify, formulate, and solve engineering problems
- f) an understanding of professional and ethical responsibility
- g) an ability to communicate effectively
- h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i) a recognition of the need for, and an ability to engage in life-long learning
- j) a knowledge of contemporary issues
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

What do we expect of our graduates?

Program Educational Objectives (civil engineering):

Graduates will meet the expectations of employers of civil engineers. Graduates will continue their professional development through graduate study if qualified and continuing education.

Program Educational Objectives (construction engineering):

Most graduates will become successful practitioners in construction engineering and relevant careers. Most graduates will be involved in professional development activities to improve their professional skills and enhance their professional credentials. Most graduates will contribute to their communities

Program Educational Objectives (environmental engineering):

Graduates will meet the expectations of employers of environmental engineers. Graduates will continue their professional development through continuing education.

For further information visit the following link

<http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2017-2018/#outcomes>