

Tuskegee University
College of Engineering
Department of Chemical Engineering

Spring 2024



Course: CENG 0220, Fluid Mechanics

Lecture Hours: MWF 9:00 AM - 10:00 AM

Instructor: Iman Hassani, PhD

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Office Hours: Mondays, Wednesdays, and Fridays from 8:00 AM to 9:00 AM and 10:00 AM to 11:00 AM, and Mondays and Wednesdays from 12:00 PM to 2:00 PM.; Others by appointment

Credit Hours: 3.0

Prerequisite: CENG 0210, PHYS 0310

Corequisite: MATH 0208

Textbook: Frank M. White and Henry Xue, Fluid Mechanics, McGraw-Hill, 9th Edition, 2021

Dress Code: Business Casual

References:

- Noel de Nevers, Fluid Mechanics for Chemical Engineers, McGraw-Hill, Third Edition, 2005.
- Robert H. Perry and Cecil H. Chilton, Chemical Engineers' Handbook, 5th Edition, McGraw-Hill, New York, 1973 (Sections 10-11).
- Warren L. McCabe, Julian C. Smith and Peter Harriott, Unit Operations of Chemical Engineering, 4th Edition, McGraw-Hill, New York, 1985.
- J. M. Coulson and J. F. Richardson, Chemical Engineering, Volume 1, 3rd Edition, Pergamon Press, 1977.
- James R. Welty, Charles E. Wicks and Robert E. Wilson, Fundamentals of Momentum, Heat, and Mass Transfer, 3rd Edition, John Wiley & Sons, 1984.
- Roberson, A. J., and Crowe, T. C., Engineering Fluid Mechanics, 6th edition, John Wiley & Sons, 1997.
- M. M. Denn, Process Fluid Mechanics, Prentice-Hall.
- R. M. Felder and R. W. Rousseau, Elementary Principles of Chemical Processes, 2nd Edition, John Wiley & Sons.
- Robert S. Brodkey and Harry C. Hershey, Transport Phenomena, 1st Edition, McGraw-Hill, 1988.
- Christie J. Geankoplis., Transport Processes and Unit Operations, 2nd Edition, Allyn & Bacon, 1983.

- R. V. Giles, J. B. Evett, and C. Liu, Schaum's Outline Series Fluid Mechanics and Hydraulics, 3rd Ed., McGraw-Hill, New York, 1994.
- M. C. Potter and C. W. Somerton, Schaum's Outline Series Thermodynamics for Engineers, McGraw-Hill, New York, 1993.

General Policies:

- Attendance is important for the successful completion of this course. Students are expected to attend all scheduled classes. A student who arrives in class after the beginning of class will be considered absent but may still attend the remainder of the class. The attendance grade will be based on the percentage of classes present (or excused).
- **Office hours are at your disposal to discuss missed classes, provided there's a valid excuse. Yet, in cases where a class is missed without a valid excuse, there won't be arrangements for scheduling office hours to cover the missed material.**
- Students are not allowed to schedule any meetings, appointments, etc., anytime during class unless inevitable and discussed with the instructor beforehand.
- All assignments are due at the beginning of class on the due date. Due dates may be extended at the professor's discretion.
- **No late homework is accepted. ALL HOMEWORK must be turned in complete in order for the student to be eligible to sit for the final exam.**
- Submitting the bonus homework isn't compulsory, but it's strongly encouraged.
- **No late design project is accepted.**
- A "day" for the purpose of defining early, timely and late assignments is referenced to the beginning of a scheduled class period. Assignments must be submitted in class and given to the instructor.
- **Assignments must be submitted through Canvas. Submissions via email will result in a grade of zero.**
- Any assignments or reports which appear to have been copied will result in a grade of zero for all students involved.
- You should show all your work in homework, tests, exams, or quizzes, not just to receive partial credit in cases where your answer is not correct but also to support your answer and receive full credit when correct. Correct answers that are not fully supported by work will generally not receive full credit.
- Cheating will not be tolerated. **Any student caught cheating will get a zero for that exam.**
- A second offense will result in an F for the course.
- Be prepared to answer questions during the lecture and ask questions on the topic that you do not understand. Also, be prepared to work out example/homework problems on the board.
- Students are not allowed to talk with each other during lectures, quizzes, exams, and final exam. If there is an emergency, the students need to go outside of the class to talk for maintaining a better learning environment in the classroom.
- The student is expected to attend regularly all classes in an attire that meets the College's Dress Code Policy of Business Casual. Students who are not attired appropriately will be asked to leave class and may return with appropriate dress. Students may return with the

tardy noted; however, students who do not return will receive an absence. The instructor has the right to establish the rules and regulations for the classroom for it to be a conducive place for teaching and learning. The classroom is the place for the beginning of professional training.

- The final exam will be done in the exam white book given by the instructor in pen.
- Cell phones must be turned off and put away during quizzes, exams, and final exam; otherwise, it will be considered a form of cheating. Cell phones cannot be used as a calculator.
- Cell phones must be turned off as soon as students enter the class and remain off during class. The use of Cell phones during class is discouraged at all times as it is distracting to the user, the instructor, and other students. If a cell phone is seen during class, you may be asked to leave, and the class will be counted as an absence.
- All Quizzes/Tests/Final exam will be CLOSED everything (any book, note, homework, cell phone, etc.) except a standard calculator. The instructor may give you all the required information and equations. Note that students need to know the derivation of some required equations.
- Students must use a basic calculator without equation memory. Advanced calculators are not allowed during Quizzes/Tests/Final exam to promote genuine understanding and problem-solving skills.
- You will have 3 tests throughout the semester and ALL test scores will count towards the calculation of your final grade.
- No bathroom breaks are allowed during exams. Please use the restroom before the exam starts. Exiting during the exam results in the completion of the test.
- Quizzes will be announced or unannounced and may be given at any time for 5 to 10 minutes. You will not get extra time if you arrive late. Students who miss a quiz without an official excuse will receive a zero for that work.
- No sharing of any materials (e.g., calculator) during exams.
- No make-up assignments (tests, quizzes, and design problems) will be given.

Exceptions:

- University allowed excuses with WRITTEN PROOF.
- Medical reasons with WRITTEN PROOF.
- In the event of a medical emergency, proof must be provided within 24 hours of the student's return to campus or release from doctor's care.
- In the event of an excused absence, make-up assignments must be done by the next class meeting following the date of the excused absence (unless scheduled with the instructor). The student is responsible for his/her own missed assignments.
- A student, who has a medical excuse (i.e., a note from a physician or qualified health care facility) for missing an exam, waives that excuse when he/she shows up at the exam and begins to take the exam. A make-up exam will not be given.
- It is likely that any makeup work will need to be scheduled during the interim period. Thus, a student with a valid excuse will receive a grade of I in the course until the work is made up. The exception is if the score on the missed work does not impact the final letter grade. In this case, no make-up assignment will be given. Regarding exams, the first excused absence for an exam will result in the substitution of the final exam score for that exam grade. General makeup policies apply for subsequent excused absences from exams.

- Effective Spring 2012, the 4uskegee.edu email system at Tuskegee University is required for all instructional administrators, faculty, staff, and students.
- Effective Fall 2023, all instructional administrators, faculty, staff, and students are required to use Canvas.
- Students are expected to write emails using responsible, courteous, and professional language.
- Academic dishonesty policies outlined in the undergraduate handbook will be strictly enforced.

Grading Criteria:

Category	Percentage (%)
Exams	40
Final Exam	30
Design Projects	10
Homework and Quizzes	10
Attendance	5
In-class participation	5

Final Grading Scale:

Percentage	Letter Grade
90-100	A
80-89	B
70-79	C
60-69	D
0-59	F

Course Content:

- Pumping incompressible fluids
- Fans and Compressors
- Flow regimes
- Pressure drop/energy loss due to confined flow
- Flow meters
- Viscosity
- Fluid statics
- Bernoulli's equation
- Buoyancy
- Stokes flow
- Navier Stokes (momentum balance), continuity equation (mass balance)

Course Objectives:

Students will

- Objective1. Apply knowledge of mathematics, physics and material and energy balances to fluid mechanics.
- Objective2. Identify appropriate equations for fluid statics and fluid flows to solve steady-state fluid flow problems with physical property tables.
- Objective3. Design pumps, compressors, fans, flow meters and piping.
- Objective4. Prepare design reports using word processor and computer software.

Program Outcomes:

Outcomes	1	2	3	4	5	6	7
Objective 1	x						
Objective 2	x						
Objective 3		x					
Objective 4			x				

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.