TUSKEGEE UNIVERSITY
COLLEGE OF ENGINEERING
CHEMICAL ENGINEERING DEPARTMENT
CENG 220 FLUID MECHANICS
Spring 2020

INSTRUCTOR:	Tamara Floyd Smith
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OFFICE/HOURS:	MWF 1-2p; others by appointment, Kresge 207
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TIME & PLACE	1:10 – 2:00 PM (MWF), Foster Hall Room 330
TEXT:	Noel de Nevers, Fluid Mechanics for Chemical Engineers, McGraw-Hill, Third Edition, 2005
PREREQUISITES	CENG 0210
COREQUISITE	MATH 208

COURSE OBJECTIVES:
Students will:
1. Apply knowledge of mathematics, physics and material and energy balances to fluid mechanics.
2. Identify appropriate equations for fluid statics and fluid flows to solve steady-state fluid flow problems with physical property tables.
3. Design pumps, compressors, fans, flow meters and piping.
4. 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 the 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 judgement to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

COURSE OBJECTIVES:

Objectives		Course Level SLOs	
1	Apply knowledge of mathematics, physics and material and energy balances to fluid mechanics.	1	Apply principles of fluid statics (pressure forces, manometers, buoyancy)
		2	Apply principles of fluid dynamics
		3	Apply Bernoulli's equation
2	Identify appropriate equations for fluid statics and fluid flows to solve steady-state fluid flow problems with physical property tables.	4	Solve friction factor problems using appropriate formulas and physical property tables
		5	Calculate pressure drop (energy losses) in pipes
		6	Describe viscosity and its shear rate dependence
3	Design pumps, compressors, fans and flow meters.	7	Design pumps, compressors, fans and flow meters.
4	Prepare design reports using word processor and computer software	8	Demonstrate proficiency with Aspen Plus and report writing

GRADING:

Homework:	15%
Attendance:	05%
Design Problems:	20%
Regular Exams (3):	40%
Final Examination:	20%
	100%

A = 90-100 B = 80-89 C = 70-79 D = 40-69 F = 0-39

POLICIES:

- Assignments submitted at least one day early will receive a 10% bonus.
- Late assignments will be accepted with the following penalties; 1 day – 15%, 2 days 50%, 3 days – no credit. Assignments must be submitted in class or delivered to the receptionist at the instructor's primary office in Kresge. Assignments placed in mailboxes are submitted at your own risk.
- Bonuses and penalties are based on the total points possible.
- A "day" for the purpose of defining early, timely and late assignments is 1:15p on a lecture day.
- Assignment due dates will be extended at the professor's discretion for any of the following reasons: unavailability during posted office hours, lack of information in the problem statement, lack of information based on material covered in class, etc.
- There will be a mandatory ASPEN training session near the end of the course.
- 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.

- A student, who has a medical excuse (i.e. 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.
- Cell phones and other electronic devices are prohibited during exams. Standard calculators are the exception to the rule.
- No headphones or earbuds, talking or turning around or sharing of any materials during exams. This includes calculators, books, notes, etc.
- When time is called for an exam, continuing to write anything other than your name will result in the loss of points (~ 1 point per second).
- Effective Spring 2012, the email system at Tuskegee University is required for all instructional administrators, faculty, staff and students.
- Effective Spring 2012, all instructional administrators, faculty, staff and students are required to use Blackboard and Starfish.
- Academic dishonesty policies outlined in the *Academic Regulations and Procedures for Undergraduates* will be strictly enforced.

REFERENCES:

1. Robert H. Perry and Cecil H. Chilton, Chemical Engineers' Handbook, 5th Edition, McGraw-Hill, New York, 1973 (Sections 10-11).
2. Warren L. McCabe, Julian C. Smith and Peter Harriott, Unit Operations of Chemical Engineering, 4th Edition, McGraw-Hill, New York, 1985.
3. J. M. Coulson and J. F. Richardson, Chemical Engineering, Volume 1, 3rd Edition, Pergamon Press, 1977.
4. James R. Welty, Charles E. Wicks and Robert E. Wilson, Fundamentals of Momentum, Heat, and Mass Transfer, 3rd Edition, John Wiley & Sons, 1984.
5. Roberson, A. J., and Crowe, T. C., Engineering Fluid Mechanics, 6th edition, John Wiley & Sons, 1997.
6. M. M. Denn, Process Fluid Mechanics, Prentice-Hall.
7. R. M. Felder and R. W. Rousseau, Elementary Principles of Chemical Processes, 2nd Edition, John Wiley & Sons.
8. Robert S. Brodkey and Harry C. Hershey, Transport Phenomena, 1st Edition, McGraw-Hill, 1988.
9. Christie J. Geankoplis., Transport Processes and Unit Operations, 2nd Edition, Allyn & Bacon, 1983.
10. R. V. Giles, J. B. Evett, and C. Liu, Schaum's Outline Series Fluid Mechanics and Hydraulics, 3rd Ed., McGraw-Hill, New York, 1994.
11. M. C. Potter and C. W. Somerton, Schaum's Outline Series Thermodynamics for Engineers, McGraw-Hill, New York, 1993.

COURSE TOPICS

1. Pumping incompressible fluids
2. Fans and Compressors
3. Flow regimes
4. Pressure drop/energy loss due to confined flow
5. Flow meters
6. Viscosity
7. Fluid statics
8. Bernoulli’s equation
9. Buoyancy
10. Stokes flow
11. Microfluidics
12. Navier Stokes (momentum balance), continuity equation (mass balance)

Transcribed Image Text from this Question. Fluid mechanics Spring 2020 2. A viscous liquid of constant p and y flows as below between two parallel plates. The top plate is moving at, and the bottom plate is fud. Solve the Navier-Stokes equation for the velocity profile for this open flow. Since most chemical processing applications are conducted either partially or totally in the fluid phase, chemical engineers need a strong understanding of fluid mechanics.Â Part II turns to microscopic fluid mechanics, which coversDifferential equations of fluid mechanics Viscous-flow problems, some including polymer processingLaplace's equation, irrotational, and porous-media flows Nearly unidirectional flows, from boundary layers to lubrication, calendering, and thin-film applicationsTurbulent flows, showing how the k/Îµ method extends conventional mixing-length theoryBubble motion, two-phase flow, and fluidizationNon-Newtonian fluids, including inelastic and. CENG 0210 MATH 208. COURSE OBJECTIVES: Students will: 1. Apply knowledge of mathematics, physics and material and energy balances to fluid mechanics. 2. Identify appropriate equations for fluid statics and fluid flows to solve steady-state fluid flow problems with. physical property tables. 3. Design pumps, compressors, fans, flow meters and piping. 4. Prepare design reports using word processor and computer software. COURSE OUTCOMES: Outcomes. MEM 221 Fluid Mechanics II 4.0 Credits. Covers differential analysis of fluid flow, including the Eulerâ€™s equations, potential flows, and the Navier-Stokes equations; angular momentum and its application to turbomachinery; external flow and boundary layers, and an introduction to compressible flow. College/Department: College of Engineering Repeat Status: Not repeatable for credit Prerequisites: MEM 220 [Min Grade: D]. MEM 230 Mechanics of Materials I 0.0-4.0 Credits.Â An overview of the application of mechanical engineering to biological systems. Covers basic anatomy and physiology; tissue, joint, cell, and protein mechanics; joint kinematics; biofluid mechanics; biothermodynamics; biotransport; biomimetic controls; and biomanufacturing. Journal of Fluid Mechanics is the leading international journal in the field and is essential reading for all those concerned with developments in fluid mechanics. It publishes authoritative articles covering theoretical, computational and experimental investigations of all aspects of the mechanics of fluids. Each issue contains papers on the fundamental aspects of fluid mechanics and its applications to other fields such as aeronautics, astrophysics, biology, chemical and mechanical engineering, hydraulics, materials, meteorology, oceanography, geology, acoustics and combustion. Recently publ