Department of Chemical & Materials Engineering
CHME 305 Syllabus – Spring 2015
Transport Operations I: Fluid Flow

Catalog Description

• Theory of momentum transport. Unified treatment via equations of change. Shell balance solution to 1-D problems in viscous flow. Analysis of chemical engineering unit operations involving fluid flow. General design and operation of fluid flow equipment and piping networks. Chemical engineering majors must earn C or better in this course.

Pre-requisites

• CHME 201 and MATH 291G. Corequisite: CHME 392

Textbook

Course Objectives

• The objective of CHME 305 is to prepare you for competency in introductory fluid mechanics so that you are equipped to solve problems that lead to design and analysis of fluid systems in support of the chemical & materials engineering curriculum

Topics Covered

By the end of the course, you should be able to do the following things:

• Mathematical Solutions: solve applied math problems involving linear ordinary differential equations and partial differential equations; identify how coordinate systems are used with ODEs and PDEs; simplify second order PDEs with assumptions; identify when an analytical solution to a PDE is possible and when numerical methods are required.

• Basic Fluid Concepts and Calculations: identify the properties of fluids, calculate problems that involve pressure measurements, fluid statics, and fluid kinematics; describe physical phenomena of fluid flow; define and explain viscosity, density, specific gravity, surface forces, velocity fields, Newtonian vs. Non-Newtonian, laminar flow, turbulent flow, Reynold’s number, and other fluid motion topics.

• Bernoulli and Energy Equations: apply the Bernoulli equation to sets of fluid problems; solve energy balances in the context of fluids and fluid motion, distinguish between approximations of and appropriate models for Bernoulli’s Equation (i.e friction losses, x, pumps, compressors, turbines, surface forces, gas-liquid flow, non-Newtonian fluids, and the Moody diagram).

• Momentum Analysis: apply momentum balances using the governing equations of momentum to solve one dimensional velocity profile problems of external or
internal viscous fluid flow; interpret the different approximations of the momentum balance; classify differential vs. integral forms of momentum analysis; and calculate problems using the Navier Stoke’s Equations.

• **Special topics:** identify different turbo- and fluid-machinery; explain why computational fluid dynamics is important; solve problems using external flow with applications: boundary layers, lift, drag; and calculate problems with dimensional analysis methods

### Class/Laboratory Schedule
- MWF 2:30-3:20PM, Jett Hall room 283

### Instructor
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### Policies and Procedures

*Teaching Assistant:* Maryam Omidvarkordshouli <omidvar@nmsu.edu>
Maryam is a chemical engineering graduate student and will be the TA for this class. Maryam will grade your homework and quizzes substitute for Dr. Houston only if she has to be out. Dr. Houston will grade your exams. Maryam can answer questions related to the course content, about homework, about your homework grades, or anything related to the course. Please email Maryam for availability/office hours/help.

**Assessment**
- Exam I (100 points)—20%; Exam II (100 points)—20%; Exam III (100 points)—20%; Exam IV (Final, 100 points)—20%; Homework (100*)—10%; Quizzes (100*)—10%
*HW and Quiz scores will be normalized.*

**Grading Scale**
- A ≥ 90%; B ≥ 80%; C ≥ 70%  No fractional grading.

**Grading Rubric**
- 10 points - problem solution completely correct
- 9 points - logic of solution completely correct, numerical error in solution
- 7 points - slight error in logic of solution, but solution thought through to end
- 5 points - moderate logic error in solution
- 3 points - major logic error in solution
- 1 points – valid attempt, but incorrect logic
- no points - no attempt at solution

**Make-up Work**
Missed quizzes and exams cannot be made up. With a valid excuse homework assignments can be made up within 1 week past due date.
Learn.nmsu.edu
In this class be prepared to use Canvas. Canvas is a website specifically designed for grades, course information and homework assignments; it will be used by Dr. Houston extensively throughout the semester. To access this website go to learn.nmsu.edu. Dr. Houston will upload pertinent class information to the ChE 305 class Canvas site including the syllabus, course calendar, some homework assignments, and your grades. Additionally students might be expected to upload homework and/or other solutions to the Canvas website when they are completed.

Assignment Information
All assignments (homework, quizzes, and exams) are noted in Canvas under the 'Assignments' link for the CHME-305-M01 class. Expect that assignments and/or their due dates are subject to change at any time. When changes occur, they will be announced during the lecture, and sometimes the change may NOT be reflected on our Canvas website! Therefore it is up to you to attend the lecture or verify with Dr. Houston when assignments are due and what content are expected.

Additionally, a course calendar document will be provided through Canvas for you to download. This document is a copy of the due dates and details about each assignment. For example, the calendar will have information about what is to be on each exam, readings to be completed, topics to be covered, how to locate problems, details for class cancellations (i.e. Spring Break), how to turn in homework, expectations on group work, when quizzes are administered, and the time of the final exam. The course calendar will be posted on the Canvas website and will be subject to modification. Refer to the “course calendar” often to be sure you are following the latest version.

All homework assignments are to be turned into Dr. Houston at the beginning of class (2:30PM) on the day it is due. All homework must be labeled with the student name, problem numbers, date, and ID at the top of the page. DO NOT plagiarize, copy solutions, or allow your classmates to blatantly copy your solutions.

Extra Credit
In this course there may be an opportunity for extra credit. If so, extra credit will be announced in class and factored into the grade at the end of the semester.

Withdrawals
Students will not receive an automatic drop for persistent absences or failure to complete assignments. The responsibility for withdrawals is completely up to the student.

Incomplete Grades
If the student is passing this course and has extenuating circumstances that permit him/her from completing the course, a grade of incomplete (I) will be given.

Syllabus Preparation Date
• 1/8/15

The NMSU Department of Chemical Engineering maintains a syllabus addendum containing course requirements common to all courses with the CH E prefix online. This document is accessible from the URL:

http://cbme.nmsu.edu/academics/syllabi/