Fall 2019

CHE 260-001: Fluid Flow

David C. Venerus

CHE 260
Fluid Flow
Fall 2019

Instructor: David C. Venerus
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Office Hours: Mon & Wed 9:00-10:30 AM, or by appointment.

Teaching Assistant: TBD

Course Description: CHE260 - Fluid Flow (3-0-3) This course considers the principles of molecular and turbulent transport of momentum, particularly as they apply to pressure drop calculations in piping systems, packed columns, and other flow devices. Flow around submerged objects is also considered. Prerequisite: CHE 230; Corequisites: CHE 240 and MATH 222

Course Objectives:

1. Provide students with the knowledge and fundamentals of fluid mechanics as well as the tools/skills needed to design complex flow systems, including packed and fluidized beds.
2. Develop mathematical models of physical phenomena and apply these to solve engineering problems in fluid mechanics.
3. Provide exposure to other engineering topics such as process safety, energy conservation, and pollution prevention in designing fluid flow systems.

Textbook: *Transport Processes and Separation Process Principles, 5th Ed.*, Geankoplis, Hersel and Lepek (GHL), Prentice Hall (2018).

Grading: Exam #1 (30%), Exam #2 (30%), Final Exam (30%), Quizzes (10%)

Homework and Quizes: Homework will be assigned, but not graded, and solutions posted on Canvas. Quizzes (sometimes unannounced) will be given to encourage students to attend lectures, read textbook, and do homework.

Canvas: Announcements, assignments, solutions etc., posted at https://canvas.njit.edu/

Important Dates:
September 10 No Lecture
October 22 Exam # 1
November 11 Last Day to Withdraw
November 26 Exam #2
December 15-20 Final Exam Week

Expectations and Rules:

1. Students are expected to attend all lectures and to be seated by the time the lectures begins.
2. During class, students are expected to be attentive, take notes and be prepared to answer questions from the instructor.
3. Students are expected to have completed the reading assignment before lecture.
4. Students are expected to bring a calculator to all lectures and exams.
5. All exams are open textbook only (no notes or other papers are allowed). Students owning an e-book version of the textbook can use an approved hard-copy of the textbook during exams.
6. Cell phone, tablet and laptop use is **not** permitted during lectures and exams.

Computer Skills: Several problems will be assigned that require basic numerical methods to solve. It is each student's responsibility to be familiar with the use of computing software such as MS Excel and MATLAB, or similar computing tools.

ADA Statement: Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Office of Accessibility and Resources. Please go to https://www.njit.edu/studentsuccess/accessibility/ for further information.

Academic Integrity: The NJIT Honor Code and Standards of Academic Integrity will be enforced in this course. Any violation will be immediately brought to the attention of the Dean of Students. Students are encouraged to read and be familiar with the University Code on Academic Integrity, which can be found at https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

CHE 260
Fluid Flow
Specific Course Goals

The student will be able to:

1. define what a fluid is and obtain fluid properties
2. work with the units of fluid dynamics variables and convert between different unit systems
3. formulate and solve the equation of hydrostatics
4. classify different types of fluids based on their rheological behavior
5. explain laminar and turbulent flows and calculate Reynolds Number
6. formulate and solve macroscopic (overall) mass and momentum balances
7. formulate and solve differential (shell) mass and momentum balances
8. predict mechanical friction losses based on correlations for different components of pipe systems
9. formulate and solve overall mass and mechanical energy balance equations for flow in pipe systems
10. describe different types of fluid moving devices and their characteristics
11. size (design) a pump based on the use of overall mass and mechanical energy balance equations for flow in pipe systems
12. describe different types of flow measurement devices
13. formulate and solve overall mass and mechanical energy balance equations for different flow measurement devices
14. formulate and solve overall mass and mechanical energy balance equations for flow past immersed objects
15. formulate and solve overall mass and mechanical energy balance equations for flow in packed beds
16. solve equations numerically using appropriate software and writing appropriate code

This course explicitly addresses the ABET student outcomes 1, 3, 4, and 7

CHE 260
Fluid Flow
Outline (GHL)

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1. Physical Quantities and Math Review (1.1-1.5)
2. Hydrostatics and Pressure (2.1,2.2)
3. Fluid Flow and Stress (3.1,3.2)
4. Macroscopic (Overall) Mass and Momentum Balances (4.1,4.3)
5. Differential (Shell) Mass and Momentum Balances for 1-D Laminar Flows (4.4)
   EXAM #1
6. Flow in Pipes and the Friction Factor (5.1)
7. Differential Mass and Momentum Balances (8.1-8.3)
8. Macroscopic Mechanical Energy Balance (4.2,5.1,5.2)
9. Flow Rate Measurement (5.3)
   EXAM #2
10. Pumps and Compressors (7.1,7.2)
11. Flow in Packed and Fluidized Beds (6.1-6.3)
    FINAL EXAM