# DEPARTMENT OF MECHANICAL and AEROSPACE ENGINEERING

# MAE 303 – Fluid Mechanics

Fall 2013

# Instructor: Dr. Gregory V. Selby

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**Office Hours:** Monday and Wednesday before or after class – or please call me for appointment

## Course Description

An introduction to the science of fluid mechanics, including a review of the basic equations governing the mechanics of fluids. Physical understanding of subject material and fundamental approaches to problem solving are emphasized. Various solution techniques are applied to a variety of fluid flow problems. Use of the computer as an aide in obtaining solutions is incorporated into the course.

## Prerequisites

ME 205, Dynamics

MATH 307, Ordinary Differential Equations

MATH 312, Calculus III

## Textbook

A Brief Introduction to Fluid Mechanics, B. R. Munson, D. F. Young, and T. H. Okiishi, John Wiley and Sons, 2008 (6thEd).

## Course Objectives

Successful completion of the course will allow students to:

1. perform manometer calculations;
2. determine forces on plane submerged surfaces;
3. calculate buoyant force on submerged bodies;
4. solve problems using continuity, momentum, and energy conservation equations;
5. analyze pipe flow systems;
6. determine lift and drag forces on aerodynamic bodies; and
7. perform model studies using the Buckingham Pi theorem.

Learning Outcomes

Pertinent learning outcomes include:

1. an ability to apply knowledge of mathematics, science, and engineering;
2. an ability to identify, formulate, and solve engineering problems;
3. the broad education necessary to understand the impact of engineering solutions in a global and societal context;
4. a knowledge of contemporary issues;
5. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practices; and
6. an ability to apply the knowledge of differential equations and multivariate calculus to mechanical engineering design and analysis problems.

## Course Topics

1. Introduction (1 class)
2. Fluid Statics (2 classes)
3. Bernoulli Equation (1/3 class)
4. Velocity and Acceleration Fields (1/3 class)
5. Differential Analysis (1/3 class)
6. Control Volume Analysis (2 classes)
7. Flow in Pipes (2 classes)
8. Dimensional Analysis ½ class)
9. External Flow (1 class)

Problem Solving Sessions (1 class)

Quizzes/Tests (1 ½ classes)

Final Exam (1 class)

## Computer Projects

Perform iterative analysis of pipe flow problems (topic 7)

## Term Projects or Papers

One extra-credit group research paper on a contemporary fluid mechanics topic will be assigned.

## Laboratory Projects

Simple tabletop experiments will be assigned.

## Contribution of Course to Meeting the Professional Component

College-level mathematics and basic science: 0 credits

Engineering topics: 3 credits

General education: 0 credits

## Design Content

0 credit hours

## Grading

Homework – 20%

Quizzes – 5%

Tests (3 one-hour) – 50%

Tabletop Experiments – 5%

Final Exam – 20%

## Prepared by

Gregory V. Selby, Ph.D.