# ME 303 – Fluid Mechanics

## Fall 2011

**Class and instructor information:**

**Section A1**

*Sheryl Grace*
Rm 407, 110 Cummington St
sgrace@bu.edu
617-353-7364

PHO 205 MW 10-12

Discussion sections:
PHO 202 T 9-10
PSY B47 M 2-3
GCB 203 T 4-5 (to be deleted)

GTF: Anush Krishnan

**Section B1**

*Matthias Schneider*
Rm 301, 110 Cummington St
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PHO 203 TH 12-2

Discussion sections:
PHO 201 T 9-10
CAS 229 M 2-3
GCB 208 T 4-5 (to be deleted)

GTF: Ke Zhang

**Course Prereq:** EK301 Engineering Mechanics

**Course Textbook:**

*Fundamentals of Fluid Mechanics,* 6th ed., Munson B.R., Young D.F., Okiishi T.H., and Huebsch, W.W., Wiley, 2009

Students can obtain earlier editions of this text or e-versions. Students in section B1 can borrow a copy of the text from Professor Schneider.

**Reference Texts:**

*Fluid Mechanics*, Landau and Lifshitz, Vol. 6
*Fluid Mechanics*, Y. Cengel and J. Cimbala
*Fluid Mechanics*, White
*Fluid Mechanics*, Fox and MacDonald

**Course web resources:**

This course makes heavy use of the Blackboard online learning environment. All course material, announcements and course information will be distributed via Blackboard. Each

section will maintain its own website but material on each site will be similar.

**Course Goals:**

This course will introduce students to the fundamental principles of fluid mechanics, emphasizing the understanding of physical and intuitive concepts.

**Learning Outcomes:** As an outcome of completing this course, students will:

i. Develop the ability to model and analyze one and two-dimensional (static and dynamic) fluid mechanical systems using applicable natural laws including those for ideal gases, and conservation of mass, momentum and energy, utilizing the control volume approach.
ii. Gain increased understanding of the experimental physical and intuitive aspects of fluid mechanics, and the ability to judge when experiments, rather than (or in conjunction with) mathematical analysis are most likely to produce the desired solutions through methods such as dimensional analysis.
iii. Gain experience in performing fluids laboratory experiments as part of a team and interpreting results. Gain experience in writing individual technical reports on laboratory projects.
iv. Gain experience in generating simple computer solutions to fluid mechanics problems.
v. Gain insight into the application of fluid mechanics to practical problems in a variety of disciplines emphasizing aerospace and mechanical engineering, but also including bio- and civil engineering.

**Homework policy:**

Homework will be assigned weekly and discussed as part of the discussion section. It will not be collected and graded. The solutions will be posted on the course website. Students are encouraged to work together and discuss the homework in order to gain a better understanding of the material.

**Quizzes:**

Weekly quizzes will be given in class covering material from the homework. These will be collected and graded. The solutions will be covered in the discussion sections.

**Discussion sections:**

There are weekly discussions sections associated with this course. Students should attend! The GTF's for the course will run these sessions and the faculty may occasionally drop by. Example problems will be worked out as part of the discussion. Questions on homework problems will be taken during the discussion. Information concerning labs will be covered most heavily in the discussion sections. Quiz solutions will be reviewed in the discussion.

**Laboratories:**

There are three labs associated with this class. Dates for the labs as well as sign up forms will be posted on the course website. The laboratory experiment will be completed in groups. The lab reports will be written individually. They will be graded both for technical content and for

writing accuracy and clarity. More information concerning appropriate laboratory report format will be posted on the course website. Prelab assignments will be due at the beginning of discussion section on the designated week, graded during the discussion, and handed back at the end of the discussion. The content of the prelab will be covered as part of the discussion.

**Grading scheme:**

Quizzes : 15%
Labs : 15%
Midterm Exam: 30%
Final Exam: 40%

Remember: Professor do not *give* grades, students *earn* grades.

**Lecture by topic:**

This plan is subject to change, but approximately we will cover the following subjects by lecture:

1. Fundamentals (Intro, history, scales, ideal gas, viscosity, Newtonian/nonnewtonian)
2. Fundamentals (cont) (Compressibility, force, Surface tension)
3. Fluid statics **Perform Reynolds Lab**
4. Fluid statics (cont)
5. Bernoulli Equation
6. Bernoulli Eq. (cont.) (balls, compressible Bernoulli)
7. Fluid kinematics
8. Fluid kinematics (cont.)
9. Conservation laws – control volume approach
10. Conservation laws (cont.) **Perform small wind tunnel lab**
11. *Catch up/recallibration lecture*
12. Differential analysis of fluids
13. Navier-Stokes equations
14. Navier-Stokes equations (cont.)
15. **Midterm EXAM (topics 1 -12)**
16. Viscous flow
17. Dimensional analysis, Buckingham Pi theorem
18. Dimensionless groups, experiments and modeling
19. Similitude
20. Pipe flow **Perform pipe flow lab**
21. Pipe flow (cont**.)**
22. Pipe flow (cont.)
23. Flow over bodies, boundary layers, drag and lift
24. Flow over bodies (cont.)
25. Special topics
26. Special topics