ENGG 2230 – Fluid Mechanics

School of Engineering
University of Guelph
Winter 2007

Instructor: Dr. Bill J. Van Heyst, P.Eng. (bvanheys@uoguelph.ca)
Room 1333 A.A. Thornbrough; Ext. 53665

GTA: Matthew MacPhail (mmacphai@uoguelph.ca)
Taylor Roumeliotis (troumeli@uoguelph.ca)

Lab Tech: Ken Graham (ext. 53924)

Lecture Times: Tuesday and Thursday @ 1:00 – 2:20 MCLN 102

Tutorial Times:
Tuesday 12:00 – 12:50 MACK 306
Tuesday 2:30 – 3:20 MACK 309
Wednesday 12:30 – 1:20 MACK 307
Wednesday 1:30 – 2:20 MACK 306

Lab Times:
(all in Thrn 1193)

Monday 2:30 - 4:20	Wednesday 2:30 - 4:20
Tuesday 10:00 - 11:50	Thursday 2:30 - 4:20

Wednesday 10:30 - 12:20 (only if required)

Text: F.M. White, 2008 (?), *Fluid Mechanics, 6th Edition*, McGraw-Hill Higher Education, 864 pages.

Exams: Mid Term: Thursday, March 1, 2007, in class
Final: Thursday, April 12, 2007, 11:30 – 1:30, room TBA

Prerequisites: As stated in the U. of G. Calendar

COURSE OBJECTIVE

The objective of the course is to introduce the fundamentals of fluid mechanics for engineers. The emphasis of the course is on the basics of fluid statics and fluid motion with applications in a variety of engineering fields.

EVALUATION

Final grades will be determined in the following manner:

- Final Exam 50 %
- Mid Term 25 %
- Laboratory Report 20 %
- IDEAS Project 5 %

Note: If you fail (< 50%) the midterm and the final, you will receive a failing grade in the course equal to the highest of the midterm or the final.

Major Holy Days

The student must contact the instructor within the first two weeks of class if academic consideration is to be requested due to religious reasons.

Problem Sets and Tutorials

Problem sets will be issued on a weekly basis, typically during Thursday's lecture, to assist students in mastering the course content. The tutorial sessions will be used as a time to answer questions regarding the assigned problems with the assistance of the GTAs. Attendance is not mandatory but any information given out during the tutorials will be considered part of the course material. **The problem sets will not be graded.** This policy is consistent with a learner-based environment and it is advisable that students complete these assignments.

Lab Reports:

The laboratory forms a vital part of the course; material introduced in the lab may be part of the final and mid-term exams. Labs will be done in groups of three students. You may choose your own group provided the names are submitted to my office no later than Thursday, January 11th at 15:00. Ensure that your group has a common time slot available in one of the allotted laboratory times. After this time I will assign the remaining students to groups. There are 5 labs in total for the course with 10 time slots available over two weeks to complete a lab. The labs are 'self-scheduled' but you must sign up for a timeslot on the bulletin board outside of THRN 1193. All five lab experiments will be set up in the Fluids Lab and can be conducted in any order. Groups will be responsible for ensuring that they complete all the labs over the course of the term. Weeks available to do the labs and due dates of each of the five labs are given below. Attendance in the lab is mandatory. No grades will be issued to any group member who is not in attendance when the lab is completed by the group.

Before coming to the laboratory to perform an experiment, each group must have read and understood the corresponding handout. Lab manuals are available on WebCT and you are expected to obtain a copy for yourself. You are expected to do the intermediate calculations and, in some cases, all the calculations before leaving the room. Each group is to submit a single typed report for each experiment. These are to be either long reports or short reports. Each group member will be responsible for one long report during the semester. For this report, the member responsible will receive a double weighting. Reports beyond the long report requirements for the group are to be short reports (*i.e.* most groups will submit 3 long reports and 2 short reports).

The format of the long report is described in the lab handout. It is to be no longer than 7 pages. Note that these 7 pages includes **everything**, including one page for the title page, one page for the signed raw data sheet, and the remainder in 5 pages. Short reports should only include a short statement of the purpose of the lab, the data collected, how calculations were performed, answers to the required questions in the lab and a short conclusion section.

The laboratory reports are due in the submission box **(In Box 298)** on the first floor of the engineering building at 5:00 pm on the dates given below. A late report will be penalized by 10% per day late. The reports must be entirely original. Plagiarism, of any form, will not be tolerated and will be forwarded to the Director of the School of Engineering for Academic Misconduct consideration. All labs will be returned at the end of the semester **(Out Box 250)**.

Each lab report (long or short) is to include the 'raw data' sheet used to record the data while doing the experiment. This sheet is to be signed and dated by either the lab technician or the GTA for the course.

Lab Dates

Lab Dates	Due Date
Jan 15- Jan 26	Friday, Feb 02
Jan 29 - Feb 09	Friday, Feb 16
Feb 12 - Mar 02	Friday, Mar 09
Mar 05 - Mar16	Friday, Mar 23
Mar 19 - Mar 30	Thursday, Apr 05

UGS NX Assignment

All students will be required to submit an assignment using UGS NX, a CAD program with computational fluid dynamics modelling capabilities. This assignment will build on earlier assignments completed as part of ENGG*2100 and ENGG*2120. Details on this assignment will be made available later in the course.

Midterm and Final Exams:

The material covered will include the last lecture prior to the exam. The exams will be closed book. Permitted aids will be announced prior to test. Failure to attend the exam will lead to a zero for the exam. The only exception will be for students with medical excuses signed by a physician. **There will be no exceptions.**

PLEASE NOTE: ***1. There will be no supplemental work given for improved grades.***
2. A failing grade will be assessed when a solution is fundamentally flawed.

LECTURE TOPICS

1 Introduction
- fluid properties: viscosity, density, vapour pressure, elasticity, temperature effects
- Newtonian and non-Newtonian fluids
- Reynolds Number
- surface tension

2 Fluid Statics
- pressure and its measurement
- hydrostatics: pressures, forces
- buoyancy and stability

3 Fluid Motion – Control Volume
- control volume analysis
- continuity: mass, volume
- momentum
- energy: Bernoulli Equation

4 Fluid Motion - Differential Relationships
- continuity, momentum

5 Dynamic Similitude and Dimensional Analysis
- Buckingham PI theorem
- modelling

6 Viscous Flow in Pipes
- laminar versus turbulent
- friction losses: Darcy
- Weisbach Eq, Moody Diagram
- minor losses, equivalent lengths
- piping systems

7 Boundary Layer Theory
- viscous drag
- forces on 3-D objects
- lift forces

8 Pumps
- pump types, characteristics
- pump and system curves
- net positive suction head, cavitation

9 Open Channel Flow Principles
- specific energy
- Manning equation
- hydraulic jumps

DISCLAIMER

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to University of Guelph Academic Regulations.