Ryerson University

Department of Aerospace Engineering

Course Outline

AER 316: Fluid Mechanics

Instructor: **Paul Walsh**, office: ENG 145, phone: (416) 979-5000 ext. 7729
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Prerequisite: AER 222, MTH 240, MTL 200, PCS 211, PCS 213

Required Text: **Fluid Mechanics, 6th ed**., Frank W. White, McGraw Hill, 2008, ISBN 0-07-293844-7

Course Objectives:
This is a first course in fluid dynamics. Basic definitions and properties of fluids are presented. Fluid hydrostatics, mass and momentum conservation, and idealized energy methods are all presented. At the end of this course, the student will have a rudimentary understanding of analytical techniques used in incompressible fluid dynamics. The student will also have an appreciation for the limitations of such techniques.

Course Organization:
The course is presented in 3 one hour lectures pre week with a two hour laboratory on alternate weeks, running for a total of 13 weeks.

Course Evaluation:

4 Labs	20%
2 mid-term exams	30%
Final Exam	50%

Examination Details:

Mid-terms: 1 hour in length, closed book, one 8.5" by 11" formula sheet written on both sides is permitted, calculators are permitted. Exams will be at the beginning of October and mid November.

Final Exam: 3 hours in length, closed book, two 8.5" by 11" formula sheets written on both sides are permitted, calculators are permitted. The Exam will be during the December exam period.

Note: All laboratory reports will be assessed not only on their technical/academic merit, but also on the communication skills exhibited through them.

Course Website:
A course website is available on Blackboard and at the instructors homepage;
www.ryerson.ca/~p3walsh

Laboratory Details:
The course lab manual will be available at the bookstore under the title 'MEC516'. Students are expected to obtain the manual and read through the relevant portions before a scheduled lab session. Instructions on lab procedures, lab report format, due dates, and expectations are included on a separate sheet available on the course website.

Course Content:

Lecture Topics	Text Sections
Introduction: introduction and definitions; continuum flow; dimensions and units; fluid properties: velocity, density, pressure, viscosity, specific gravity, surface tension; streamlines, streaklines, and pathlines.	1.4 - 1.9, 1,11
Hydrostatics: pressure and pressure gradients; hydrostatic pressure in gases; manometry; hydrostatic forces on plane surfaces; buoyancy and stability.	2.1, 2.3 – 2.5, 2.8
Control volume method: integral relations for control volumes and control surfaces; conservation relations of mass, linear momentum, angular momentum, and energy; Bernoulli's equation; hydraulic and energy gradients.	3.1 – 3.7
Differential equations for fluid flow: vector representation of a fluid velocity field; the Navier-Stokes equations; incompressible flow; Euler's equation; viscous flow; laminar and turbulent flow; incompressible viscous flow.	4.1 – 4.3, 4.5, 4.6, 4.10
Dimensional analysis: similarity, dimensions, Buckingham Pi theorem; dimensionless parameters and their use.	5.1 – 5.5
Viscous flow in ducts: Reynolds number regimes; pipe flow; head losses and the friction factor; Moody diagram; minor losses.	6.1 – 6.4, 6.6, 6.7, 6.9

Faculty Course Survey:
Students will be required to complete this survey during the weeks of 10, 11 or 12.

Prepared by: _____ Date: _____
P. Walsh

Approved by: _____ Date: _____
D. Greatrix