MECH 502: Fluid Mechanics
Winter semester 2010

Instructor: I.A. Frigaard
Times: Tuesdays & Thursdays 2.00 – 3.30pm, starting on Tuesday 14th Sept. You will be e-mailed reading material for the 1st week of semester.
Location: CHBE 103

Synopsis:
This course will focus primarily on fluid mechanics of viscous incompressible fluids in laminar flows, with an emphasis on slow flows. The approach will be to look at fluid mechanics fundamentals, and at the mathematical modeling & analysis of simplified flow situations. Computational and experimental aspects are not addressed.

The course is intended to act as a foundation course for engineering graduate students coming from a range of backgrounds, but with previous exposure to fluid mechanics at the undergraduate level. Maturity in mathematics is required and students need to be comfortable using mathematics. You should not have forgotten about advanced & multi-variable calculus, and should have had some experience with linear constant coefficient ordinary and partial differential equations. The course involves mathematical techniques and algebraic manipulation, in order to understand the physics of different flows.

Topics covered:
Fluid mechanics is a vast subject and some pre-selection of topics is needed:
- Navier-Stokes equations, boundary conditions, scaling
- 1D problems & some approximate problems with small parameters
- Lubrication flows, squeeze films etc
- Thin film flows & variants
- Introduction to displacement flows
- Low Re flows: properties of the Stokes equations
- Flow around particles at low Re
- Special topics at low Re

Course Texts:
There is no text. Many of the topics are classical and can be found in many texts. Some texts that I have enjoyed are:
- Viscous Fluid Flow: Papanastasios, Georgiou & Alexandrou (2000)
- Fluid Dynamics - Theory, Computation, and Numerical Simulation, C. Pozrikidis
- Introduction to Fluid Mechanics, G. Batchelor (1967)
- Fluid Mechanics, P.K. Kundu & I.M. Cohen (2008, or earlier editions)
- Elementary Fluid Dynamics, D.J. Acheson (1990)
- Advanced Transport Phenomena, G. Leal (2007)
- Physical Hydrodynamics, É. Guyon, J-P. Hulin, L. Petit & C. Mitescu, (2001)

The first two accessible online via UBC library (look under e-books) and you may find the others elsewhere. These texts have slightly different flavours.

Assessment:
There will be 3 assignments during the semester (30%), a midterm (20%) and a final (50%)