Dalhousie University

Department of Oceanography

OCEA/PHYC 4311/5311 Fluid Dynamics 1

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Office Hours:

Session: Fall 2009
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Weds/Fri. 2:00-3:00 pm or e-mail for appointment

Lecture Times: Tues/Thurs 2:30-4:00 pm

Room: LSC 3652

Course Description

This course covers the scientific basics of fluid dynamics, with some emphasis on geophysically important aspects. Contents: tensor mathematics, flow kinematics, equations of motion, potential flow, basic aerodynamics, viscous flow, life at low Reynolds number, and some instabilities. Similar to chapters 2, 3, 4, 5, 6, 8, and 9 and bits of chapters 10, 12 and 15 of *Fluid Mechanics* by Kundu and Cohen. Occasional reference will be made to current research topics, especially those in oceanography.

Evaluation

Students will be evaluated by means of three or four problem sets (60%), a project (20%) and an in-class final exam (20%). A higher level is expected from graduate students, especially in the project (must go beyond the books and into the primary literature) and exam (more questions must be answered). All marking is done by the instructor. The mark for the assignments will be a weighted average of the marks for the individual assignments, as some assignments are longer than others. After the first marking of each assignment, students may turn in a corrected assignment within one week. For each properly corrected answer, the students will receive 50% of the difference between their original mark and the total assigned marks. (E.g. if the original mark was 4/10, the final mark after a full correction was turned in would be 7/10). The grading scheme will be as follows: A+, 90-100%; A, 85-89.9%; A-, 80-84.9%; B+, 75-79.9%; B, 70-74.9%; B-, 65-69.9%; C+, 62-64.9%; C, 58-61.9%; C-, 55-57.9%; D, 50-54.9%; F, <50%.

Project Details

The project will consist of a term paper exploring an an advanced or modern topic in fluid dynamics. This can take the form of an application of the material covered in class (e.g. the fluid dynamics of insect flight or hydraulic control of channel flow), a theoretical extension (i.e. delve deeper into one of the subjects covered and share it with your classmates), or a laboratory demonstration (there are limited facilities for this, in particular, a rotating tank in LSC 5640) . Students will be evaluated on both a written report and a 15-minute presentation to the class. Please discuss topics with me to assure their suitability.

Textbooks

- Kundu, P. and I. M. Cohen. 2008 (any edition will do). *Fluid Mechanics*. Elsevier Academic Press.
- Other useful reading:
  - Batchelor, G.K. 2000. *An Introduction to Fluid Dynamics*. Cambridge University Press.
  - Acheson, D.J. 1990. *Elementary Fluid Dynamics*. Cambridge University Press.
  - Tritton, D.J. 1988. *Physical Fluid Dynamics*. Oxford University Press.
  - Lighthill, J. 1988. *An Informal Introduction to Theoretical Fluid Mechanics*. Oxford University Press.
  - Walker, J. 1977. *The Flying Circus of Physics*. Wiley.
  - *Annual Review of Fluid Mechanics*.

Miscellaneous

Prerequisites: ODEs, PDEs, complex variable theory, vectors and vector integral theorems, and basic classical mechanics.

If this course is completed at the undergraduate level, it cannot be retaken for credit at the graduate level.