

**Faculty of Science Course Syllabus**  
**Department of Oceanography**  
OCEA 4311/5311  
Fluid Dynamics I  
Winter 2016

**Instructor(s):** David Barclay dbarclay@dal.ca LSC Ocean 5672

**Lectures:** Tues/Thurs, 1:05 pm – 2:25 pm, LSC-Common Area C214

**Office hours:** Monday, 1:30 – 2:30 pm

**Laboratories:** 0

**Tutorials:** 0

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### **Course Description**

An introduction to the theory of fluid dynamics, with some emphasis on geophysically important aspects. Contents: tensor mathematics, flow kinematics, equations of motion, viscous flow, potential flow, convection, turbulence, and basic aerodynamics. Occasional reference will be made to current research topics, especially those in Physical Oceanography.

### **Course Prerequisites**

Intended for first-year graduate students in physical oceanography, but graduate students or senior undergraduates in Mathematics or Physics are invited to take it (subject to instructor approval). Familiarity with vectors, vector calculus, ordinary differential equations, partial differential equations, complex variables and classical mechanics required.

### **Course Objectives/Learning Outcomes**

The students should expect to gain a theoretical and phenomenological basis of basic fluid dynamics as a foundation for advanced courses in atmospheric science, physical oceanography, and ocean engineering. The course content will be skewed towards problems relevant to oceanography, and focus mainly on analytical methods, with an introduction to computational approaches.

### **Course Materials**

Textbook: Kundu, P. and I. M. Cohen, 2004. *Fluid Mechanics*. Elsevier Academic Press.

Complimentary and alternate:

Batchelor, G.K. 2000. *An Introduction to Fluid Dynamics*. Cambridge University Press.

Lighthill, J. 1988. *An Informal Introduction to Theoretical Fluid Mechanics*. Oxford University Press.

Website: [noise.phys.ocean.dal.ca/teaching.html](http://noise.phys.ocean.dal.ca/teaching.html)

## Course Assessment

Component	Weight (% of final grade)	Date
<i>Midterm</i>	20%	<i>February 11th</i>
<i>Final exam</i>	40%	<i>TBD</i>
<i>Assignments</i>	25%	<i>weekly</i>
<i>Video assignment</i>	15%	<i>March 31st</i>

An alternative-grading scheme will be available in the form of Final exam (75%), assignments (10%), and video assignment (15%). The scheme that produces the higher grade will be automatically applied.

## Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

## Course Policies

Late assignments will not be accepted. There is no option for a make-up midterm in the case of an absence.

Three lectures at the end of the course will be reserved in the case of course overrun or lectures lost to snow days. In the case of no snow days (!), the special topics of compressible fluids, acoustics and stability will be covered.

## Course Content

- Week 1 – Fluids & hydrostatics*
- Week 2 – Flow fields*
- Week 3 – Conservation equations*
- Week 4 – Equations of motion and dynamic similarity*
- Week 5 – Viscous flows*
- Week 6 – Wind driven flow in a basin/Midterm*
- Week 7 – Bernoulli's Equation*
- Week 8 – Potential flow*
- Week 9 – More potential flow and vorticity*
- Week 10 – Turbulent and laminar flow*
- Week 11 – Boundary layer flow and compressible fluids*
- Week 12 – Acoustic gravity waves & movie presentation*
- Week 13 – Hydrodynamic stability*

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## ACCOMMODATION POLICY FOR STUDENTS

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic protected under Canadian Human Rights legislation. The full text of Dalhousie's Student Accommodation Policy can be accessed here:

[http://www.dal.ca/dept/university\\_secretariat/policies/academic/student-accommodation-policy-wef-sep--1--2014.html](http://www.dal.ca/dept/university_secretariat/policies/academic/student-accommodation-policy-wef-sep--1--2014.html)

Students who require accommodation for classroom participation or the writing of tests and exams should make their request to the **Advising and Access Services Centre (AASC)** prior to or at the outset of the regular academic year. More information and the ***Request for Accommodation*** form are available at [www.dal.ca/access](http://www.dal.ca/access).

## **ACADEMIC INTEGRITY**

Academic integrity, with its embodied values, is seen as a foundation of Dalhousie University. It is the responsibility of all students to be familiar with behaviours and practices associated with academic integrity. Instructors are required to forward any suspected cases of plagiarism or other forms of academic cheating to the Academic Integrity Officer for their Faculty.

The Academic Integrity website (<http://academicintegrity.dal.ca>) provides students and faculty with information on plagiarism and other forms of academic dishonesty, and has resources to help students succeed honestly. The full text of Dalhousie's ***Policy on Intellectual Honesty*** and ***Faculty Discipline Procedures*** is available here:

[http://www.dal.ca/dept/university\\_secretariat/academic-integrity/academic-policies.html](http://www.dal.ca/dept/university_secretariat/academic-integrity/academic-policies.html)

## **STUDENT CODE OF CONDUCT**

Dalhousie University has a student code of conduct, and it is expected that students will adhere to the code during their participation in lectures and other activities associated with this course. In general:

“The University treats students as adults free to organize their own personal lives, behaviour and associations subject only to the law, and to University regulations that are necessary to protect

- the integrity and proper functioning of the academic and non – academic programs and activities of the University or its faculties, schools or departments;
- the peaceful and safe enjoyment of University facilities by other members of the University and the public;
- the freedom of members of the University to participate reasonably in the programs of the University and in activities on the University's premises;
- the property of the University or its members.”

The full text of the code can be found here:

[http://www.dal.ca/dept/university\\_secretariat/policies/student-life/code-of-student-conduct.html](http://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html)

## **COPYRIGHT**

All members of the Dalhousie community are expected to comply with their obligations under Canadian copyright law. Dalhousie copyright policies and guidelines, including our Fair Dealing Guidelines, are available at <http://www.dal.ca/dept/copyrightoffice.html>. Copyright questions should be directed to the Copyright Office at [copyright.office@dal.ca](mailto:copyright.office@dal.ca).

**SERVICES AVAILABLE TO STUDENTS**

The following campus services are available to help students develop skills in library research, scientific writing, and effective study habits. The services are available to all Dalhousie students and, unless noted otherwise, are free.

<b>Service</b>	<b>Support Provided</b>	<b>Location</b>	<b>Contact</b>
<b>General Academic Advising</b>	Help with <ul style="list-style-type: none"> <li>- understanding degree requirements and academic regulations</li> <li>- choosing your major</li> <li>- achieving your educational or career goals</li> <li>- dealing with academic or other difficulties</li> </ul>	<b>Killam Library Ground floor</b> Rm G28 <b>Bissett Centre for Academic Success</b>	In person: Killam Library Rm G28 By appointment: <ul style="list-style-type: none"> <li>- e-mail: <a href="mailto:advising@dal.ca">advising@dal.ca</a></li> <li>- Phone: (902) 494-3077</li> <li>- Book online through MyDal</li> </ul>
<b>Dalhousie Libraries</b>	Help to find books and articles for assignments Help with citing sources in the text of your paper and preparation of bibliography	<b>Killam Library Ground floor</b>  Librarian offices	In person: Service Point (Ground floor) By appointment: Identify your subject librarian (URL below) and contact by email or phone to arrange a time: <a href="http://dal.beta.libguides.com/sb.php?subject_id=34328">http://dal.beta.libguides.com/sb.php?subject_id=34328</a>
<b>Studying for Success (SFS)</b>	Help to develop essential study skills through small group workshops or one-on-one coaching sessions Match to a tutor for help in course-specific content (for a reasonable fee)	<b>Killam Library 3<sup>rd</sup> floor</b>  Coordinator Rm 3104 Study Coaches Rm 3103	To make an appointment: <ul style="list-style-type: none"> <li>- Visit main office (Killam Library main floor, Rm G28)</li> <li>- Call (902) 494-3077</li> <li>- email Coordinator at: <a href="mailto:sfs@dal.ca">sfs@dal.ca</a> or</li> <li>- Simply drop in to see us during posted office hours</li> </ul> <b>All information can be found on our website: <a href="http://www.dal.ca/sfs">www.dal.ca/sfs</a></b>
<b>Writing Centre</b>	Meet with coach/tutor to discuss writing assignments (e.g., lab report, research paper, thesis, poster) <ul style="list-style-type: none"> <li>- Learn to integrate source material into your own work appropriately</li> <li>- Learn about disciplinary writing from a peer or staff member in your field</li> </ul>	<b>Killam Library Ground floor</b> Learning Commons & Rm G25	To make an appointment: <ul style="list-style-type: none"> <li>- Visit the Centre (Rm G25) and book an appointment</li> <li>- Call (902) 494-1963</li> <li>- email <a href="mailto:writingcentre@dal.ca">writingcentre@dal.ca</a></li> <li>- Book online through MyDal</li> </ul> We are open six days a week <b>See our website: <a href="http://writingcentre.dal.ca">writingcentre.dal.ca</a></b>