

CARLETON UNIVERSITY
Department of Mechanical & Aerospace Engineering

COURSE OUTLINE for MECH 5008
EXPERIMENTAL METHODS IN FLUID MECHANICS
Sean McTavish, Fall 2017

3174 Mackenzie Bldg, Wednesdays 6:05 pm – 8:55 pm

Week Topic

- 1 Basic measurement concepts
- 2 Signal characteristics and calibrations
- 3 Data acquisition and signal analysis-1
- 4 Wind tunnel design-1
- 5 Flow visualization
- 6 Probability and Statistics
- 7 Pressure measurements
- 8 No classes – fall reading week
- 9 Error propagation and uncertainty
- 10 Wind tunnel design-2
- 11 Force measurement
- 12 Signal analysis-2
- 13 Turbulence measurement
- 14 Temperature measurement, mass/volume flow measurement

Lectures will be a combination of slides (see cuLearn for print-outs to bring to class) and hand-written notes on the chalkboard.

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your **Letter of Accommodation** at the beginning of the term, and no later than two weeks before the first assignment is due. **Requests made within two weeks will be reviewed on a case-by-case basis.** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam.

Assignments: Three assignments will be given throughout the term, with each project involving the review of a measurement technique in fluid mechanics. You will be given 2 weeks to complete Assignment 1 and 3 weeks to complete Assignments 2 and 3.

All assignments are to be submitted in hard-copy at the beginning (first 15 minutes) of the class in which they are due. Late submissions will receive a 15% penalty for each week they are late and emailed copies are not accepted. All papers should include appropriate references and follow the formatting style provided for each.

Assignment 1 – Provided 27 Sept, due 11 Oct.

Assignment 2 – Provided 18 Oct, due Nov 8.

Assignment 3 – Provided 8 Nov, due 29 Nov.

Final exam: There will be a 48-hr take-home, open-book final examination. The final exam papers will not be returned to the students.

Course Grades: The final exam will count for 45% of the final grade. Assignment 1 will count for 15% of the final grade, assignment 2 will count for 20% of the final grade, and assignment 3 will count for 20% of the final grade.

Unofficial Prerequisites: A familiarity with fluid dynamics, aerodynamics and data analysis is important. There are many good resources online and in textbooks; if you are not familiar with basic aerodynamic and fluid dynamic concepts it is important that you review these subjects prior to the mid-point in the course where we will start to talk more in depth about various measurement techniques.

Library Resources and Unofficial References:

- Goldstein, Richard J., *Fluid Mechanics Measurements*, Hemisphere Publishing Corporation.
- Tavoularis, S., *Measurements in Fluid Mechanics*, Cambridge University Press.
- Benedict, R.P., *Fundamentals of Temperature, Pressure and Flow Measurement*, John Wiley & Sons Inc.
- Rae & Pope, *Low-Speed Wind Tunnel Testing*, John Wiley & Sons Inc.
- Anderson, J. D., *Fundamentals of Aerodynamics*, McGraw Hill.
- Journal Article Databases:
 - Science Direct (Elsevier journals)
 - Scopus
 - Springer Link

Contact Information: Email: sean.mctavish@carleton.ca (best way to reach me)
Phone: 613-990-1356 (NRC office phone)

Please note that I am unavailable for in-person consultations during the day and do not have office-hours. If you would like to meet in person to discuss something we can meet in the evening before class.

My Background:

- B.Eng.(2006), M.A.Sc.(2008) Carleton, PhD (2013) Carleton, Postdoc (2013) University of Toronto
- PhD thesis:
Identification of wind turbine testing practices and investigation of the performance benefits of closely-spaced lateral wind farm configurations
- Researcher in the NRC Aerospace Portfolio - Aerodynamics Laboratory, Bluff Body Aerodynamics Group

Areas of Experience:

- Low-Speed Experimental Aerodynamics
- Wind tunnel testing for vehicles, bridge cables, shipboard aerodynamics
- Static and dynamic testing

Later in the semester, I will try to arrange for an optional tour of some of the NRC wind tunnels for the class (depending on their availability). More details to come later in the semester.

Course Rules:

Penalties: Late submissions will receive a 15% penalty for each week they are late and emailed copies are not accepted.

Plagiarism: Please review the Carleton University Academic Integrity Policy. Any papers or take-home exams violating the academic integrity policy will be referred to the Dean's office. The Dean will review any allegation and will contact the student directly if required.

<https://carleton.ca/senate/wp-content/uploads/Academic-Integrity-Policy1.pdf>
<https://carleton.ca/slals/credit-esl/plagiarism-cheating/>

Language: Clear and concise communication skills are essential in engineering. In each assignment, 10% of the total mark will be allocated to spelling and grammar. Use spell-check, and if English isn't your first language, consider asking a friend to review the paper before you submit it.