

Western University - Faculty of Engineering
Department of Civil and Environmental Engineering

CEE 9693b – Bluff Body Aerodynamics
Course Outline – winter 2017

Objectives:

This is a graduate course focusing on the advanced fluid mechanical aspects of bluff body aerodynamics. While the theoretical, experimental and computational aspects of the aerodynamics around streamlined bodies are highly developed, flows around bluff bodies have remained more elusive to both theory and computation. This is largely because of the role of turbulence, very high Reynolds numbers, and the complex flow fields that occur in applications such as wind loads on structures. The purpose of the course is to aid the student in understanding the role of the various factors which impact the aerodynamic loads on bluff bodies in the wind, as well as to familiarize the student on the use of the data analysis methods used to understand bluff body flows.

The course will use a variety of styles to present the topics including traditional lectures, the use of experimental data from a variety of sources, and group discussions pertaining to the review of scientific papers and the student's own analysis of the provided data. In order for group discussions to be effective, the student must be committed to completing assigned readings from the literature prior to class. Students will also be expected to participate in the classes directly. Assignments will be based around analysis of archived experimental data, together with review of published literature as related to the analysis of the data. Students will make brief presentations of their findings for all assignments, to the class. Because the course will rely to a great extent on the use of experimental data, it is expected that the students are (or will become) reasonably proficient in the use of computer data-analysis software such as Matlab.

Students will learn:

- (i) basic concepts of conducting research, through completion of the assignments
- (ii) communication skills, through the presentation of assignment results
- (iii) technical details pertaining to the course topics

Topics:

1. Aerodynamic Forces
2. Analysis of Time-varying Signals
3. Boundary Layers and Shear Layers
4. Separation and Reattachment
5. Effects of Turbulence on Flow Around Bluff Bodies
6. Quasi-steady Theory
7. Wind Tunnel Test methods

Prerequisite:

This course is intended for graduate students in the area of fluid dynamics, wind engineering, and aerodynamics. It is hoped they will have taken basic courses in viscous flow or boundary layer theory as an undergraduate or graduate student. Students without such experience should discuss with the instructor prior to registration.

Corequisite:

None

Antirequisite:

None

Note: It is the **student's responsibility** to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the **student's responsibility** to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

Instructor:

Dr Gregory A. Kopp, SEB 2078, email: gakopp@uwo.ca. *Administrative Support:* SEB 2079

Total Number of Contact Hours:

Two lecture hours per week (total of 24 hours).

Course Materials:

There is no text book available for this course. Various papers in the literature will be studied. Some will be discussed in class, although students will be expected to do significant reading for these assignments.

There are several excellent books which address only partial aspects of the course materials including: (i) Turbulent Flows, by Stephen Pope, Cambridge University Press, (ii) Flow-Induced Vibration, by Robert Blevins, Krieger Publishing Co., (iii) Physical Fluid Dynamics, by D.J. Tritton, Oxford University Press, (iv) Wind Effects on Structures, by Emil Simiu and Robert Scanlan, Wiley, (v) Wind Loading of Structures, by John Holmes, Spon Press.

Prepared class notes will be made available through the course OWL site at <http://owl.uwo.ca/>, along with other useful reference material and data for assignments.

Computing:

Assignments will require the processing of experimental data using computer data-analysis software such as Matlab or similar, and students will be assumed to be proficient in the use of the software of their choice.

Units:

SI units will be used in lectures and examinations

Evaluation:

The final course mark will be determined as follows:

5 Assignments:	75%
In-Class Presentations:	15%
Participation:	10%

Total	100%

Use of English:

In accordance with Senate and Faculty Policy, students may be penalised up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Scholastic Offences:

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_grad.pdf.

Plagiarism:

University policy states that plagiarism, defined as the “act or an instance of copying or stealing another’s words or ideas and attributing them as one’s own.” (excerpted from Black’s Law Dictionary, West Group, 1999, 7th ed., p. 1170) is a scholastic offence. In submitting any written work as part of the coursework requirements for this course students must ensure that this work is written in their own words. Whenever students take an idea or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

A student who is found guilty of plagiarism in respect of any written work submitted as part of the coursework requirements for this course will be given a grade of zero for the submitted work. Repeated acts of plagiarism, either in this course or any other course subsequent to a first offence, will result in the student being given a failing grade for the course in which the subsequent offence occurs, and may also incur further penalties such as requiring the student to withdraw from the program in which they are enrolled in.

Attendance:

Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Accessibility:

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Conduct:

Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam.

On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: <http://www.uwo.ca/univsec/board/code.pdf>.

Sickness and Other Problems:

Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, please see:
http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf.

Graduate Course Health and Wellness Insert for Graduate Course Outlines:

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html

To help you learn more about mental health, Western has developed an interactive mental health learning module, found here: http://www.health.uwo.ca/mental_health/module.html. This module is 30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.

Notice:

Students are responsible for regularly checking their email, and the course OWL site for new notices related to the course.