Western University
Faculty of Engineering
Department of Civil and Environmental Engineering

CEE 9526 – Wind Engineering

COURSE OUTLINE 2023-2024

DESCRIPTION

This course covers a large range of wind engineering topics from climatology to the atmospheric boundary layer, bluff body aerodynamics and fluid structure interaction problems.

The general objectives are for the student to be able to:

- Understand the fundamental basis of the major elements of the Alan Davenport wind loading chain.
- Demonstrate and use specific atmospheric science, statistics, fluid mechanics, and structural engineering methods in solving practical problems in Wind Engineering.
- Understand and use the Wind section of the Canadian Building Code to estimate wind generated loading and responses on structures.
- Understand the basic boundary layer wind tunnel techniques related to the wind engineering practice.
- Recognize the need for life-long learning to keep abreast of new experimental and computational tools in order to enhance one's abilities as an engineer.

ENROLLMENT RESTRICTIONS

Enrollment in this course is restricted to graduate students in Civil and Environmental Engineering department, as well as any student that has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

INSTRUCTOR CONTACT INFORMATION

Course instructor: Jin Wang, PhD
Email address: jwan2225@uwo.ca
Office: ACEB # 4400B
Office hours: Friday's 9:30 to 10:30 AM

COURSE FORMAT

Face-to-face

TOPICS

Topic	Description	Tentative timeline
	Introduction to the wind engineering course and guideline for in-person class	Week 1
1	*Governing principles for wind in the Atmospheric Boundary Layer (ABL)* • Atmosphere • Wind climate • Governing equations • Geostrophic and Gradient wind speeds	Week 2
2	*Tropical storms, wind structure and mean velocity in the ABL* • Tropical storms, hurricanes & typhoons • Non-synoptic winds: downbursts & tornadoes • Wind structure • Wind spectrum & scales • Mean velocity profiles	Week 3
3	*Turbulence* • Probability distribution function • power spectrum • Kolmogorov theory • Correlations & length scales	Week 4
4	*Extreme wind speeds* • Wind velocity probability distribution • Extreme wind speeds • Choice of design return period • Extreme speed in local & tropical storms	Week 5
5	*Bluff body aerodynamics* • Ideal, viscous, and turbulent storms • Aerodynamic forces	Week 6
6	*Wind/structure interaction* • Quasi-steady theory	Week 7
7	*Response to turbulent wind* • Along-wind response • Gust effect factor	Week 9
8	*Wind-induced aero-elastic instabilities of structures* • Aerodynamic damping • Galloping • Flutter	Week 10
10	*International building codes and standards*	Week 11
11	*Final project presentation*	Week 12-13

There is ‘No Class’ in reading week (October 30th-November 5th, 2023).

SPECIFC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
Depth and breadth of knowledge	30%	• Assignments • Project	• Understanding of advanced concepts and theories • Awareness of important current problems in the field of study • Understanding of computational and/or empirical methodologies to solve related problems
Research & scholarship	10%	• Assignments • Project	• Ability to conduct critical evaluation of current advancements in the field of specialization • Ability to conduct coherent and thorough analyses of complex problems using established techniques/principles and judgment
Application of knowledge	30%	• Assignments • Project	• Ability to apply knowledge in a rational way to analyze a particular problem • Ability to use coherent approach to design a particular engineering system using existing design tools
Professional capacity / autonomy	10%	• Project	• Awareness of academic integrity • Ability to implement established procedures and practices in the coursework • Defends own ideas and conclusions • Integrates reflection into his/her learning process
Communication skills	10%	• Project • Assignment	• Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively
Awareness of limits of knowledge	10%	• Project • Assignment	• Awareness of the need of assumptions in complex scientific analyses and their consequences • Understanding of the difference between theoretical and empirical approaches • Ability to acknowledge analytical limitation due to complexity of practical problems

ASSESSMENTS

Assessment Type	Material Covered	Tentative Due Date	Weight
Homework Assignments (total 5)	Topic 2, 3, 4, 5		25%
Project report (includes title/abstract, and final reports submissions)	Project topic to be decided later	Title and Abstract due by Week 4, and final report by Week 12.	50%
Project presentation (one), and question and answer		The presentation schedule to be decided later	25%

Computing:
Assignments will require the processing of computational data using computer data-analysis software such as Matlab, and students will be assumed to be proficient in the use of the software of their choice (e.g. Matlab. Excel or C++).

Activities in which collaboration is permitted:

- Class participation

Activities in which students must work alone (collaboration is not permitted):

- Course projects are individual and collaborations/group work are not permitted.

REQUIRED TEXTBOOK
Prepared power point slides will be posted on OWL by Dr. Wang covering the material on a weekly basis.

OPTIONAL COURSE READINGS
"Wind Effects on Structures. Fundamentals and Applications to Design", E. Simiu, R.H. Scanlan, 3rd Edition, J. Wiley & Sons, Inc, NY, 1996
"Wind loading of structures", J. D. Holmes, CRC press, 2007.

CHEATING, PLAGIARISM/ACADEMIC OFFENCES
Academic integrity is an essential component of learning activities. Students must have a clear understanding of the course activities in which they are expected to work alone (and what working alone implies) and the activities in which they can collaborate or seek help; see information above and ask instructor for clarification if needed. Any unauthorized forms of help-seeking or collaboration will be considered an academic offense. University policy states that cheating is an academic offence. If you are caught cheating, there will be no second warning. Students must write their essays and assignments 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. Plagiarism is a major academic offence. Academic offences are taken seriously and attended by academic penalties which may include expulsion from the program. Students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence at the following website: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

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).

CONDUCT
Students are expected to follow proper etiquette to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in course activities and/or is not following the rules and responsibilities associated with the course

activities, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student could be debarred from completing the assessment activities in the course as appropriate.

HEALTH/WELLNESS SERVICES

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several health and wellness related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. 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. Faculty of Engineering has a Student Wellness Counsellor. Information on how to schedule an appointment with the counsellor is available at: https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/Student-Wellness-Counselling.html

Students who are in emotional/mental distress should refer to Mental Health@Western: http://www.uwo.ca/uwocom/mentalhealth/ for a complete list of options about how to obtain help.

SICKNESS

Students should immediately consult with the Instructor (for a particular course) or Associate Chair (Graduate) (for a range of courses) if they have problems that could affect their performance. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal. Obtaining appropriate documentation (e.g., a note from the doctor) is valuable when asking for accommodation due to illness.

Students who are not able to meet certain academic responsibilities due to medical, compassionate or other legitimate reason(s), could request for academic consideration. The Graduate Academic Accommodation Policy and Procedure details are available at: https://www.eng.uwo.ca/graduate/current-students/academic-support-and-accommodations/index.html

ACCESSIBLE EDUCATION WESTERN (AEW)

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program. Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are strongly encouraged to register with Accessible Education Western (AEW): http://academicsupport.uwo.ca/accessible_education/index.html

AEW is a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both AEW and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that

appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.