

Western University
Faculty of Engineering
Department of Civil & Environmental Engineering

CEE 9524b – Wind Loads on Building Components & Cladding

COURSE OUTLINE Winter 2021

DESCRIPTION

Much of the damage observed to buildings following severe windstorms is to the components and cladding (C&C). When major structural failures do occur, they are often closely related to the failure of a connection or a cladding element. The objectives of this course are to provide an introduction to wind loads and effects on these building systems.

PREREQUISITES

This course is intended for graduate students enrolled in civil or mechanical engineering, particularly those working in the areas of wind engineering, structural engineering, or fluid dynamics.

TOPICS

Topic	Description	Learning Activities	(Tentative) Dates of Live Sessions
	Discussion of Course Outline, Requirements, and Expectations	-	January 12
1	Introductory and Background Material a. Observations of building performance during extreme wind storms; definitions and terminology b. Introduction of typical building and Component and Cladding (C&C) systems c. Introduction to EF-Scale d. Statistical analysis and tools	All items have the requirement to view pre-recorded material and participate in live sessions. Additional requirements are listed: a, c. read scientific paper and create video summary b. conduct literature search and create video summary	a. January 19 b. January 19, 26 c. January 26 d. January 26
2	Design Wind Loads a. Wind speeds for design; synoptic storms, tornadoes b. External pressures on buildings c. Area-averaging and equivalent static wind loads d. Equivalent static wind loads on single layer systems; code-based wind loads e. Internal pressures	All items have the requirement to view pre-recorded material and participate in live sessions. Additional requirements are listed: a. read scientific paper and create video summary; assignment b. read scientific paper and create video summary c. assignment	a. February 2 b. February 9 c, d. February 23 e. March 2

3	C&C System Response and Limit States a. Load paths and load sharing b. Influence surfaces and effective wind area c. Standardized and research-based test methods d. Fasteners e. Single-layer panels f. Putting it together: re-visiting the EF-Scale	All items have the requirement to view pre-recorded material and participate in live sessions. Additional requirements are listed: a, b, d. assignment c, f. read scientific paper and create video summary	March 9, 16
4.	Advanced Issues a. Spatial, temporal, and load duration considerations b. Pressure equalization and multi-layer systems c. Static fatigue and glazing d. Low-cycle fatigue e. Wind-borne debris	All items have the requirement to view pre-recorded material and participate in live sessions. Additional requirements are listed: a - e. assignment; read scientific paper and create video summary	March 23, 30

SPECIFIC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
Depth and breadth of knowledge	30%	<ul style="list-style-type: none"> • Assignments • Scientific paper reviews 	<ul style="list-style-type: none"> • 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%	<ul style="list-style-type: none"> • Assignments • Scientific paper reviews 	<ul style="list-style-type: none"> • 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%	<ul style="list-style-type: none"> • Assignments 	<ul style="list-style-type: none"> • 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	5%	<ul style="list-style-type: none"> • Assignments • Live session discussions 	<ul style="list-style-type: none"> • 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	20%	<ul style="list-style-type: none"> • Assignments • Scientific paper reviews • Live session discussions 	<ul style="list-style-type: none"> • Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively
Awareness of limits of knowledge	5%	<ul style="list-style-type: none"> • Scientific paper reviews 	<ul style="list-style-type: none"> • 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

By the end of the course, the student should:

1. Be able to identify different types of building components and cladding and the wind issues/loads/effects associated with them;
2. Have a basic understanding of aerodynamic loads on building components, cladding and equipment, and how different parameters may alter them;
3. Be able to compute wind loads from building codes and wind tunnel experiments, with a basic understanding how the code provisions were developed;
4. Understand the procedures of standardized component tests and the approximations used to develop them;
5. Understand the response characteristics of different C&C systems and how this affects design considerations;
6. Be able to compute (i) area-averaged wind loads appropriate for C&C systems using wind tunnel data considering peak pressures, low-cycle fatigue, and static fatigue, as appropriate, (ii) statistics pertaining to wind loads and component responses, (iii) internal pressures using engineering models, (iv) C&C performance using standardized test data and wind loading data, and (v) flight of windborne debris in uniform flow using engineering models;
7. Understand current research issues regarding C&C performance in the scientific literature.

ASSESSMENTS

Assessment Type	Material Covered	Tentative Due Date	Weight
Assignments	Topics 2, 3, 4	Feb 23; Mar 9, Mar 23; Apr 6	60%
Literature reviews	Topics 1, 2, 3, 4	As discussed in live sessions.	20%
Participation (synchronous & asynchronous)	Participation in synchronous class activities. Post questions in course site using the "Forums" tool	See live session dates above.	10%

Activities in which collaboration is permitted:

- Live sessions will allow for collaboration

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

- Assignments and literature reviews.

CONTACT INFORMATION

Course instructor: Dr Gregory A. Kopp

Email address: gakopp@uwo.ca

Contact policy:

- Contact instructor via email (above) or through messages in OWL
- Weekly live sessions, Tuesdays, 1:30-3:30pm, are held via Zoom
- A general FAQ section on the ‘forums’ section of OWL will be used for students to pose course-related questions so that all have the same information.

REQUIRED TEXTBOOK

There is no textbook for the course. Various papers in the scientific and engineering literature will be utilized. 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 data-analysis software such as MATLAB or similar. A full version of MATLAB can be downloaded for academic use only through the MATLAB portal for Western University:

<https://www.mathworks.com/academia/tah-portal/western-university-964054.html>

Students will be assumed to be proficient in the use of the software of their choice. There may be some computing during the live in-person sessions.

COURSE CONTENT

The lecture notes and online lecture videos are copyrighted to the instructor and legally protected. Do not post these videos and lecture notes on any other website or online forums. The recording of the live/synchronous sessions of the course without the permission from the instructor is prohibited. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.

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 under “Assessments” 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 (see Western's scholastic discipline regulations for graduate students).

SYNCHRONOUS LEARNING ACTIVITIES

Students are expected to participate in synchronous learning activities as outlined in the course syllabus and/or described by the instructor. If you have issues that will impede your ability to participate in synchronous activities, please discuss with the course instructor at the beginning of the course.

CONDUCT

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

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 (remotely accessible) 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. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html
<https://www.uwo.ca/health/psych/index.html>

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.

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 Accessible

Education at 661-2111 x 82147 or http://academicsupport.uwo.ca/accessible_education/index.html, for any specific question regarding an accommodation.