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 chapters of the Wind Engineering 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 computer tools in order to enhance one’s abilities as an engineer.

PREREQUISITES: none

TOPICS

<table>
<thead>
<tr>
<th>Topic #</th>
<th>Description</th>
<th>Learning Activities</th>
<th>Tentative timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Introduction to course</td>
<td>Go over syllabus and class expectations: Recorded Introduction</td>
<td>Week 1: Sept. 9 *NO ZOOM today</td>
</tr>
<tr>
<td>1. Governing Principles for wind in the Atmospheric Boundary Layer (ABL)</td>
<td>Lecture 1: • Atmosphere • Wind Climate • Models • Governing equations • Geostrophic and Gradient wind speeds</td>
<td>• Recorded lecture • Live Zoom session: Q&amp;A on intro</td>
<td>Week 2: Sept 16 11am to 12pm EST</td>
</tr>
<tr>
<td>Lecture</td>
<td>Topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 2. Tropical Storms, Wind Structure and Mean Velocity Profile in the ABL | Lecture 2:  
- Tropical Storms, Hurricanes & Typhoons  
- Non-Synoptic winds: Downbursts & Tornadoes  
- Wind Structure  
- Wind Spectrum & Scales  
- Mean Velocity |
| 3. Turbulence | Lecture 3:  
- Turbulence  
- Probability Distribution Function  
- Power Spectrum  
- Kolmogorov Theory |
| 4. Turbulence | Lecture 4:  
- Correlations & Length Scales  
- Weibull Distribution  
- Extreme wind speeds |
| 5. Extreme wind speeds | Lecture 5  
- Cont. extreme wind speed methods  
- Choice of design return period  
- Extreme speed in local & tropical storms |
| 6 Bluff Body Aerodynamics | Lecture 6  
- Bluff Body Aerodynamics  
- Ideal Fluid  
- Viscous Fluid  
- Turbulent Flow  
- Influence functions |
| 7. Wind-structure interaction | Lecture 7  
- Intro  
- Response to random excitation  
- SDoF Linear Systems |
| 8. Wind Induce Response of Slender structures | Lecture 8  
- Response to random excitation  
- MDoF Linear Systems  
- Spectra of generalized force |
| Recorded lecture | Recorded lecture  
- Live Zoom session: Q&A on Lectures 1 and 2 |
| Recorded lecture | Recorded lecture  
- Live Zoom session: Q&A Lecture 3 |
| Recorded lecture | Recorded lecture  
- Live Zoom session: Q&A Lecture 4  
- Assignment 1 made available |
| Recorded lecture | Recorded lecture  
- Live Zoom session: Q&A Lecture 5  
- Assignment 1 completed |
| Recorded lecture | Recorded lecture  
- Live Zoom session: Q&A Lecture 6 |
| Recorded lecture | Recorded lecture  
- Live Zoom session: Q&A Lecture 7 |

Week 3: Sep. 23  
*NO ZOOM today*

Week 4: Sept 30  
11 am to 12pm EST

Week 5: Oct. 7  
11 am to 12pm EST

Week 6: Oct. 14  
11 am to 12pm EST

Week 7: Oct. 21  
11 am to 12pm EST

Week 8: Oct. 28  
11 am to 12pm EST

Week 9: Nov. 4  
11 am to 12pm EST
### 9. Response to turbulent wind

**Lecture 9**
- Response to turbulent wind
- Aerodynamic damping
- Acrosswind response
- Wake & Vortex Shedding

- Recorded lecture
- **Live Zoom** session: Q&A Lecture 8
- Assignment 2 made available

**Week 10: Nov. 11 11 am to 12pm EST**

### 10. Vortex shedding

**Lecture 10**
- Vortex Shedding for Horizontal Structures
- Review of Wind Responses

- Recorded lecture
- **Live Zoom** session: Q&A Lecture 9
- Assignment 2 completed

**Week 11: Nov. 18 11 am to 12pm EST**

### 11. NBCC

- National Building Code of Canada (NBCC)

- Recorded lecture
- **Live Zoom** session: Q&A Lecture 10

**Week 12: Nov. 25 11 am to 12pm EST**

- Review

- Review for Final Exam
- **Live Zoom** Session: Q&A Lecture 11 and general

**Week 13: Dec. 2 11 am to 12pm EST**

- EXAM

- Open book take home

**Week 14: Dec. 9**

### SPECIFIC LEARNING OUTCOMES

<table>
<thead>
<tr>
<th>Degree Level Expectation</th>
<th>Weight</th>
<th>Assessment Tools</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth and breadth of knowledge</td>
<td>45%</td>
<td>Assignments, Examination</td>
<td>Understanding of advanced concepts and theories, Awareness of important current problems in the field of study, Understanding of experimental, computational and/or empirical methodologies to solve related problems</td>
</tr>
<tr>
<td>Research &amp; scholarship</td>
<td>15%</td>
<td>Assignments, Examination</td>
<td>Ability to conduct critical evaluation of current advancements in the field of specialization</td>
</tr>
</tbody>
</table>
• Ability to conduct coherent and thorough analyses of complex problems using established techniques/principles and judgment

Application of knowledge  20%  • Assignments  • Examination  • 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%  • Assignments  • Examination  • 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%  Zoom meetings  • Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively

Awareness of limits of knowledge  5%  • Lectures  • Assignments  • 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**

<table>
<thead>
<tr>
<th>Assessment Type</th>
<th>Material Covered</th>
<th>Tentative Due Date</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework Assignments (two)</td>
<td>Topic 1 to 6 and 6 to 9</td>
<td>Oct. 21 and Nov. 18</td>
<td>40%</td>
</tr>
<tr>
<td>Participation (synchronous)</td>
<td>Attendance in synchronous class activities (every week Zoom meetings)</td>
<td>Dec. 2</td>
<td>10%</td>
</tr>
<tr>
<td>Exam: open book take home</td>
<td></td>
<td>Dec. 9</td>
<td>50%</td>
</tr>
</tbody>
</table>

**Activities in which collaboration is permitted:**
• Class (Zoom) participation

**Activities in which students must work alone (collaboration is not permitted):**
• Collaboration during exam is NOT permitted. You are to work on your own.

**CONTACT INFORMATION**
Course instructor: Dr. Horia Hangan
Email address: hmhangan@uwo.ca
Contact policy:
- Contact instructor via email (above) or through messages in OWL
- Weekly synchronous Office hours are held via Zoom: Every Wednesday between 11 am and noon with exception of Wed. Sept 09 and Wed. Sept 23. You are expected to attend each of these zoom sessions (participation will be noted).
- 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
Prepared power point slides will be posted on OWL by Dr. Hangan covering the material on a weekly basis. The slides will contain both video and audio.

OTHER REFERENCES:

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 offense. 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 x82147 or http://academicsupport.uwo.ca/accessible_education/index.html, for any specific question regarding an accommodation.