

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

**CEE 9571b – Advanced Concrete Technology**  
**Course Outline, 2023 - 2024**

**DESCRIPTION:**

This course helps students understand the properties, development, and application of the most common and advanced special concretes. It covers the rheological and mechanical properties/performance with particular focus on durability and sustainability.

**ENROLLEMENT RESTRECTIONS:**

Enrollment in this course is restricted to graduate students in civil and environmental engineering

**INSTRUCTOR CONTACT INFORMATION:**

Course instructor: Hassan EL-Chabib, PhD, P. Eng.,

Email address: [helchab2@uwo.ca](mailto:helchab2@uwo.ca)

Office: SEB3029.

Office hour: Th 10:00 am – 12:00 pm

**COURSE DELIVERY/NOTES:**

This course will be delivered in person. *“In the event of a COVID-19 resurgence that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor”.*

- When deemed necessary, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western’s Remote Proctoring website at: <https://remoteproctoring.uwo.ca>
- Class notes for each topic as well as related reference materials (if needed) will be regularly posted on the course website.
- The instructor will deliver formal lectures for all topics. In addition, students are asked to study the topic material at home and come to class with specific questions to ask, that will form the basis for class discussion.

## **TOPICS**

<b>Topic #</b>	<b>Description</b>	<b>Learning Activities</b>	<b>Tentative timeline</b>
1	Cement manufacturing, cement types and properties	Lectures/Reading material	Week 1
2	Cement hydration, microstructure, and early age behaviour	Lectures/Reading material	Week 2
3	Admixtures in Concrete	Lectures/Reading material	Week 3
4	Aggregates in concrete	Lectures/Reading material	Week 3
5	Test methods for cement and concrete	Lectures/Reading material	Week 4
6	Concrete mixture design	Lectures/Reading material	Week 5
7	Batching, mixing, handling, placing and finishing	Lectures/Reading material	Week 6
<b>READING WEEK (No Classes)</b>			
8	Rheology and properties of fresh concrete	Lectures/Reading material	Week 8
9	Mechanical properties of concrete	Lectures/Reading material	Weeks 8
10	Mass concrete	Lectures/Reading material	Week 9
11	High performance and ultra-high-performance concrete	Lectures/Reading material	Week 9/10
12	Self-consolidating concrete	Lectures/Reading material	Week 11
13	Fiber-reinforced concrete	Lectures/Reading material	Week 11
14	Shotcrete	Lectures/Reading material	Week 12
15	Pervious concrete	Lectures/Reading material	Week 12
16	Concrete sustainability	Lectures/Reading material	Week 12

## SPECIFIC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
<b>Depth and breadth of knowledge</b>	35%	<ul style="list-style-type: none"> <li>Examinations</li> </ul>	<ul style="list-style-type: none"> <li>Understanding of advanced concepts and theories</li> <li>Awareness of important current problems in the field of study</li> <li>Understanding of computational and/or empirical methodologies to solve related problems</li> </ul>
<b>Research &amp; scholarship</b>	35%	<ul style="list-style-type: none"> <li>Term paper</li> </ul>	<ul style="list-style-type: none"> <li>Ability to conduct critical evaluation of current advancements in the field of specialization.</li> <li>Ability to conduct coherent and thorough analyses of complex problems using established techniques/principles and judgment</li> </ul>
<b>Application of knowledge</b>	15%	<ul style="list-style-type: none"> <li>Examinations</li> </ul>	<ul style="list-style-type: none"> <li>Ability to apply knowledge in a rational way to analyze a particular problem.</li> <li>Ability to use coherent approach to design a particular engineering system using existing design tools</li> </ul>
<b>Professional capacity / autonomy</b>	5%	<ul style="list-style-type: none"> <li>Term paper</li> </ul>	<ul style="list-style-type: none"> <li>Awareness of academic integrity</li> <li>Ability to implement established procedures and practices in the coursework.</li> <li>Defends own ideas and conclusions.</li> <li>Integrates reflection into his/her learning process</li> </ul>
<b>Communication skills</b>	10%	<ul style="list-style-type: none"> <li>Presentation</li> </ul>	<ul style="list-style-type: none"> <li>Ability to communicate (oral and/or written) ideas, issues, results, and conclusions clearly and effectively</li> </ul>

## ASSESSMENTS

Assessment Type	Material Covered	Tentative Due Date	Weight
Final Exam	All topics	TBD	50%
Term paper	Topics to be decided later	March 24	30%
Paper presentation		Last week of classes	10%
Attendance/in class participation			10%

**Note:** Students must pass the final examination to pass this course. Students who fail the final examination will be assigned the aggregate mark, as determined above, or 48%, whichever is less.

### **ACTIVITIES IN WHICH COLABORATION IS PERMITTED:**

- Term paper and presentation, in class discussion

### **ACTIVITIES IN WHICH COLABORATION IS NOT PERMITTED:**

- Examinations

### **RECOMMENDED REFERENCES**

- Properties of Concrete, A.M. Neville, Wiley
- Concrete Admixtures Handbook, Noyes
- Manual of Concrete Practice, ACI
- Concrete Microstructure, Properties and Materials, PK Mehta and PJM Monteiro
- Technical Journals including ACI Materials Journal, Cement and Concrete Research, Materials and Structures, etc.

### **TERM PAPER**

The term paper is a group term paper and must be submitted by March 24<sup>th</sup>. Students will be divided into groups and each group will select a topic from a list provided by the instructor. A topic proposed by a group of students can be used if approved by the instructor. The term paper must be written according to the guidelines of ACI Materials Journal.

### **PRESENTATION**

At the end of the term, each group of students will have 15 minutes to present their term paper followed by a 10-minute question period. Presentations will be scheduled during the last week of classes.

**Use of English:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work, except for 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.

**Notice:** Students are responsible for regularly checking their email and the course website (<https://owl.uwo.ca>) for announcements and updates.

**Consultation:** Students are encouraged to discuss problems with their instructor during the office hours or by appointment.

### **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](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. The 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://academicssupport.uwo.ca/accessible\\_education/index.html](http://academicssupport.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.