
WESTERN UNIVERSITY
FACULTY OF ENGINEERING
Department of Civil and Environmental Engineering

CEE 9598a/b – Durability, Monitoring, and Rehabilitation of Concrete Structures

Course Outline – Winter 2021

DESCRIPTION

In this graduate course, students acquire knowledge and skills needed to tackle the problem of assessment and renewal of aging concrete structures. Students first learn the predominant mechanisms of damage in concrete structures, along with destructive and non-destructive testing methods, then use this knowledge in surface repair, crack injection and strengthening of deficient concrete structures.

PREREQUISITES: CEE 3347a/3368, CEE 3369b or their equivalent, by permission of the Instructor.

CO-REQUISITES: None.

ANTIREQUISITES: None.

TOPICS

Topic #	Description	Learning Activities	Tentative timeline
1	Lesson 1: Introduction to properties of cement and concrete	<ul style="list-style-type: none">• One synchronous lecture*• Lecture notes and study materials• Practice questions	Week 1
2	Lesson 2: Corrosion of reinforcing steel in concrete structures	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials• Practice questions	Week 2
3	Lesson 3: Freeze-thaw degradation in concrete structures	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials• Practice questions	Week 3
4	Lesson 4: Alkali-aggregate reaction in concrete structures	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials• Practice questions	Week 4
5	Lesson 5: Sulfate attack in concrete structures	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials• Practice questions	Week 5
6	Lesson 6: Dimensional stability, load effects and faulty workmanship	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials• Practice questions	Week 6
7	Lesson 7: Nondestructive testing of concrete structures	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials	Week 7
8	Lesson 8: Repair of cracks using epoxy injection	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials	Week 8
9	Lesson 9: Strengthening concrete structures using fiber-reinforced polymers	<ul style="list-style-type: none">• One synchronous lecture• Lecture notes and study materials	Week 9

10	Lesson 10: Condition survey and evaluation of concrete structures	<ul style="list-style-type: none"> One synchronous lecture Lecture notes and study materials 	Week 10
11	Lesson 11: Litigation and forensic engineering	<ul style="list-style-type: none"> One synchronous lecture Lecture notes and study materials 	Week 11
12	Term paper presentations	Student individual presentations	To be scheduled

* Attending synchronous lectures is mandatory.

Synchronous lectures will also be recorded and uploaded to the course OWL site.

SPECIFIC LEARNING OUTCOMES

Degree Level Expectation	Weight	Assessment Tools	Outcomes
Depth and breadth of knowledge	25%	<ul style="list-style-type: none"> Examinations Term paper 	<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	30%	<ul style="list-style-type: none"> Examinations Term paper 	<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	20%	<ul style="list-style-type: none"> Examinations Term paper 	<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"> Term paper Oral presentation 	<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	15%	<ul style="list-style-type: none"> Term paper Oral presentation 	<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"> Term paper 	<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

ASSESSMENTS

Assessment Type	Material Covered	Tentative Due Date	Weight
Final Examination*	Lessons 1 to 11	Final exam period	50%
Term paper	Individual topic	Last week of class	40%
Oral presentation & participation	Individual topic	Last week of class	10%

***Note:** The Final Examination will be proctored intramural. If at the time of the final exam in-person exams are not feasible, the final examination will be conducted using Zoom and related instructions will be provided.

Activities in which collaboration is permitted:

- Studying weekly lecture materials and answering study questions.
- Discussions in developing the individual term papers.
- Advice on rehearsing oral presentation.
- Students are highly encouraged to interact and discuss through the course discussion forum on OWL.

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

- Final examination: No exchange of any information with others during the final exam is permitted.

CONTACT INFORMATION

Course Instructor: M.L. Nehdi, PhD, P.Eng., FACI, FCSCE, FEIC, Professor
Email address: mnehdi@uwo.ca

Contact policy:

- Synchronous lectures (mandatory attendance): Wednesdays at 3:00 to 5:00 PM.
- Students must connect to the Zoom lecture and have their camera on clearly showing their face.
- Office hours: Fridays 12:00 -1:00 PM (Via Zoom – by appointment with instructor).
- Contact instructor via email (above) or through messages in OWL.
- Regular announcements will be made by the instructor on OWL for updates and information sharing.

REFERENCES:

The instructor will post on OWL lecture notes and other study materials related to each of the course topics. Additional textbooks, optional course readings, and other references are recommended to complement information. These are available in the UWO libraries and research databases.

COURSE CONTENT

The lecture notes and synchronous lectures are copyrighted to the instructor and legally protected. Do not post videos or lecture notes on any other website or online forums. The recording of the live/synchronous sessions of the course without explicit 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://academicssupport.uwo.ca/accessible_education/index.html, for any specific question regarding an accommodation.