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

CEE 3369A – Materials for Civil Engineering – Course Outline – 2025/26

This course introduces students to the physical properties and engineering characteristics of major civil engineering materials, such as portland cement concrete and asphalt concrete. It covers the structural, durability, and sustainability aspects of civil infrastructure, with particular focus on flexible and rigid pavements. The general objectives are for the students to develop the ability to:

- Understand the chemical composition and the hydration process of portland cement and supplementary cementitious materials.
- Recognize the effects of chemical admixtures and mineral additions on the rheological and mechanical properties of concrete mixtures.
- Design a concrete mixture to meet specific design requirements.
- Identify various mechanisms of concrete's deterioration and the actions needed to enhance concrete durability in aggressive environments.
- Recognize the performance, failure criteria and principles of modern design of rigid and flexible pavements.
- Design a flexible and rigid pavement for specific traffic, soil and environmental conditions.
- Incorporate sustainability and environmental considerations in the use of civil engineering materials,
- develop awareness of modern advances and novel applications involving civil engineering materials,
- recognize the need for life-long learning to keep abreast of new design and construction methods involving such materials, and to enhance one's design abilities.

Calendar Copy: The consideration of the physical properties and engineering characteristics of materials used in Civil Engineering.

Pre-requisites: CEE 2202A/B and CEE 2220A/B.

Co-requisites: None

Anti-requisites: None

Note: It is the student's responsibility to ensure that all Pre-requisite and Co-requisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Anti-requisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Pre-requisite, Co-requisite or Anti-requisite conditions.

Contact Hours:

- 2 lecture hours/week: Lectures will be delivered in-person. Students should review the online lectures in the week they are posted and be prepared to discuss and apply the concepts presented during the weekly lecture sessions.
- 4 two-hour laboratory session/term:
  Students will be placed in teams and complete a laboratory session four times over the course of the term. A schedule for laboratory activities will be provided by the course instructor.
- 2 tutorial hours/week: after the 4 laboratory sessions, a 2-hour in-person tutorial session/week will be delivered during the scheduled tutorial hours. Student attendance of the lecture, lab, and tutorial is mandatory.

Notes:

- In any event that necessitates the course delivery moving away from face-to-face interaction, affected 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 as determined by 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 lectures emphasize the construction of meaning rather than information transmission. Hence, students shall study the notes for each lecture at home before it is presented by the instructor in class. Home study effort is crucial for the success of students in this course. The class time is dedicated to engaging students in exploring topics in greater depth and applying knowledge to create more meaningful learning opportunities.
- The weekly 2-hour lab/tutorial sessions are crucial to understand the characteristics of the materials, finish assignments, and successfully finish the course. Students must attend and they are encouraged to seek assistance when needed.

Instructor:

Dr. Hassan EL-Chabib, P. Eng., SEB 3026A,
Email: helchab2@uwo.ca.
Office hour: Wednesday, 10:30 am – 12:30 pm or by appointment

Textbook: None

Recommended References:

- Design and Control of Concrete Mixtures, Canadian Edition, Cement Association of Canada.
- Properties of Concrete, by. A.M. Neville, John Wiley & Sons Inc.
- Concrete, by S. Mindess and J. F. Young, Prentice Hall Inc.
- Concrete Pavement Design, Construction, & Performance, by N. Delatte, Taylor & Francis.
- Pavement Analysis and Design, Y.H. Huang, Prentice Hall.

Units:

Both SI and FPS unit systems may be used in lectures, labs, tutorials, and examinations.

Specific Learning Objectives:

At the end of each section/topic, the student should be able to do the following: [GA indicator]

1. *Cement Manufacturing, Chemistry and Hydration:*
   a) Recognise the steps involved in manufacturing portland cement and the various reactions occurring in a cement kiln. [IESE1]
   b) Identify the oxide composition of portland cement and the difference in composition between different types of cements and its effect on the performance of concrete. [IESE1, IESE2]

c) Characterise the hydration reactions of the main phases in a cement clinker and the effect on their physical and chemical parameters on cement hydration kinetics. [IESE1, IESE2]
d) Identify the major phases in the microstructure of hydrated cement paste. [IESE1, IESE2]

2. *Mineral Additions and Chemical Admixtures in Concrete:*
   a) Evaluate the effect of using supplementary cementitious materials on the sustainable development of civil infrastructure and the built environment. [IESE1, IESE2]
   b) Identify the effects of using mineral admixtures such as fly ash, slag and silica fume on the workability, mechanical properties and durability of concrete. [IESE1, IESE2]
   c) Control the properties of concrete mixtures using chemical admixtures such as accelerators, retarders, superplasticizers and air-entraining admixtures. [I3]
   d) Design concrete mixtures involving mineral additions and chemical admixtures to meet specific design requirements. **[IESE2, ET2]**

3. *Aggregates and their Use in Concrete*
   a) Describe the source and geological classification of aggregates [IESE1]
   b) Analyse the physical properties and particle size gradation of aggregates. [I3]
   c) Determine the effect of aggregate use in concrete. [IESE1, IESE2]
   d) Identify harmful aggregates to mitigate their negative effects on the durability of concrete. [IESE1]

4. Workability, Mechanical Properties and Durability of Concrete
   a) Use various tests to characterise the workability of fresh concrete mixtures and recognise the effects of mixture proportions on workability. [ET2]
   b) Appreciate the time and temperature dependence of the properties of fresh and hardened concrete. [I3]
   c) Control the mechanical properties of concrete via controlling its mixture proportioning, consolidation, and curing. [ET2]
   d) Describe the performance of concrete under compressive and other mechanical loading. [ET2]
   e) Learn the development of special concretes such as fibre-reinforced concrete, self-consolidating concrete, and high-performance concrete. [IESE1]
   f) Identify the mechanisms of deterioration of concrete in different aggressive environments and develop strategies for enhancing the durability of concrete structures. [IESE, I3]

5. *Asphalt*
   a) Recognize the chemical composition of asphalt cements, their physical structure, aging, rheological properties, and classification. [IESE1, IESE2]
   b) Recognize the structure of asphalt concrete, ingredients, fillers and additives used in its making, its response to loads, desired properties, effect of temperature and moisture, durability, etc. [IESE1, IESE2, ET2]
   c) Design aggregate mixtures for paving asphalt concrete. [IESE1]
   d) Design asphalt-aggregate mixtures to meet road design specifications. [IESE2, ET2]

6. *Pavement Design*
   a) Discuss and use the principles of pavement design including the concept of design life and failure criteria. [IESE2, I3]
   b) Compute stresses and deflections in pavements using linear elastic-layered systems [IESE1, **I3**]
   c) Rationally design flexible (asphalt) and rigid (concrete) pavements using different methods (e.g. AASHTO, Asphalt Institute, or PCA) given specifications and properties of pavement materials including soil foundation, sub-grade, sub-base, and surface characteristics. **[IESE1,** ET2**]**
   d) Evaluate the performance of road pavements. [IESE1, IESE2, I3]

General Learning Objectives

E=Evaluate, T=Teach, I=Introduce

Problem Analysis	T	Teamwork	T	Ethics and Equity	-
Investigation	E/A	Communication	I	Economics and Project Management	T
Design	T	Professionalism	I	Life-Long Learning	-
Engineering Tools	T	Knowledge Base	-	Impact of Engineering on Society and the Environment	E/D

Accreditation Units:

Engineering Science = 50%, Engineering Design = 50%

Assessments:

The final course mark will be determined as follows:

Midterm Exam:	25%
Attendance/Participation:	10%
Lab :	10%
Assignments	15%
Final examination:	40%

Total:	100%

Note: (a) **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.

(b) **Students must turn in all laboratory reports, and achieve a passing grade in the laboratory component, to pass this course.** Students who do not satisfy this requirement will be assigned 48% or the aggregate mark, whichever is less.

(c) **Students who have failed an Engineering course (i.e. <50%) must repeat all components of the course.** No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories, if applicable, cannot be resubmitted for grading by the student in subsequent years.

1. **Quizzes and Examinations**
   - **Midterm Exam**: A two-hour midterm exam is scheduled for October 29th during the lecture period. The exam could be entirely closed book or 2 parts (closed and open book). Classroom to be determined.
   - **Final Exam:** A 3-hour open book final examination will be held during the final examination period

2. **Lab Reports**

   Students must attend all laboratories and submit a group report for each lab session. Students might be given the opportunity to join the group of their choice or assigned to a certain group by the instructor. Lab reports are usually due 2 weeks after the lab session is done and must be written according to the format provided on the course OWL site with the cover page signed by all group members. Late submission of lab reports will not be accepted, and all group members will receive a grade of zero unless an extension is pre-approved by the instructor.

3. **Assignments:**
A total of 5 assignments will be given in this course and should be done individually. Assignments are generally due one week after posting and late submission will receive a mark of zero unless an extension is pre-approved by the course instructor. Students are highly encouraged to solve all assignment questions to do well in the course. However, only one selected question from an assignment may be marked – the questions will not be determined or announced in advance.

4. **Participation**:
Participation will be assessed based on class attendance, participation in lectures, labs, tutorials, and completion of short in-class assessments.

I. Missed/Late Accommodation Policy:

1. Students missing a test/assignment/lab or examination must report the absence by submitting Academic Consideration Request form through STUDENT ABSENCE PORTAL.
2. Documentation must be provided as soon as possible.

II. Exam Accommodation:

1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through STUDENT ABSENCE PORTAL.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must submit an the Academic Consideration Request Form through STUDENT ABSENCE PORTAL.
PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

III. Late Assignments:

1. Students must advise the course instructor if they are having difficulty completing an assignment on time (prior to the due date of the assignment).
2. Students should be prepared to submit the Academic Consideration Request Form and provide documentation if requested to do so by the course instructor.
3. If granted an extension, a revised due date should be established with the course instructor. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments are completed prior to the last day of classes.
4. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.

Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

IV. Medical Accommodation:

1. Requests for Academic Consideration Request Form through STUDENT ABSENCE PORTAL.
2. Requests for academic consideration must include the following components:
    a. Self-attestation signed by the student (*This is only accepted for the first/one absence*)
    b. Medical note
    c. Indication of the course(s) and assessment(s) affected by the request
    d. Supporting documentation as relevant

3. Requests without supporting documentation are limited to one per term per course.
4. **Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.**
5. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline. Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Engineering.

V. Religious Accommodation:

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean. It is the responsibility of such students to take appropriate action concerning the work done in classes from which they are absent.

VI. Academic Integrity:

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit Academic Integrity Western Engineering for more information

VII. Academic Offences:

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on 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). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

VIII. Faculty of Engineering AI Policy:

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

IX. Use of English Policy:

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for 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.

X. Accessibility:

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the Accessibility Western University for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit Academic Support & Engagement -Academic Accommodation.

XI. Inclusivity, Diversity, and Respect:

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the Office of Equity, Diversity and Inclusion.

XII. Health and Well-Being:

- Health & Wellness Services – Students - Offers appointment-based medical clinic for all registered part-time and full-time students.

- Mental Health Support - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistant, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click here.
- Gender-Based Violence and Survivor Support - Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, here. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Contacts:

Engineering Undergraduate Services	SEB 2097	519-661-2130	engugrad@uwo.ca
Civil & Environmental Engineering	SEB 3005	519-661-2139	civil@uwo.ca
Office of the Registrar/Student Central	WSSB 1120	519-661-2100	

Important Links:

- WESTERN ACADEMIC CALENDAR
- ACADEMIC RIGHTS AND RESPONSIBILITIES

The document "INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED" is part of this course outline.