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

CEE 3369b – Materials for Civil Engineering
Course Outline - Winter 2022

DESCRIPTION:
This course introduces students to the physical properties and engineering characteristics of major civil engineering materials, including 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:

OBJECTIVES: The objectives of this course are for the students 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.

CONTACT INFORMATION:
Course instructor: Hassan EL-Chabib, PhD, P. Eng.,
Email Address: helchab2@uwo.ca.
Administrative support: SEB 3005.
Office hour: TBD

COURSE DELIVERY/NOTES:

- Although the intent is for this course to be delivered in-person, the changing COVID-19 landscape may necessitate some or all of the course to be delivered 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 assessments affected will 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 on 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. The 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 and to finish the design project. Students must attend and they are encouraged to seek assistance when needed.

**CONTACT HOURS:**

2 lecture hours per week; 2 lab/tutorial/design hours per week. Attendance is **mandatory.**

**PRE-REQUISITES:** CEE 2202A/B and CEE 2220A/B.

**RECOMMENDED REFERENCES:**
(2) Properties of Concrete, by. A.M. Neville, John Wiley & Sons Inc.
(3) Concrete, by S. Mindess and J. F. Young, Prentice Hall Inc.

**UNITS:**
SI units will be generally used in lectures and examinations. Occasionally, Imperial units are used.

**TOPICS**

<table>
<thead>
<tr>
<th>Topic #</th>
<th>Description</th>
<th>Learning Activities</th>
<th>Tentative timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cement manufacturing, cement types and properties</td>
<td>Lectures/Reading material</td>
<td>Week 1</td>
</tr>
<tr>
<td>2</td>
<td>Supplementary Cementitious Materials</td>
<td>Lectures/Reading material</td>
<td>Week 2</td>
</tr>
<tr>
<td>3</td>
<td>Aggregates in concrete</td>
<td>Lectures/Reading material</td>
<td>Week 3</td>
</tr>
<tr>
<td>4</td>
<td>Mixing water and admixtures in concrete</td>
<td>Lectures/Reading material</td>
<td>Week 4</td>
</tr>
<tr>
<td>5</td>
<td>Concrete durability</td>
<td>Lectures/Reading material</td>
<td>Week 5</td>
</tr>
<tr>
<td>Week</td>
<td>Design of concrete mixture</td>
<td>Lectures/Reading material</td>
<td>Week 6-7</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------</td>
<td>---------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>6</td>
<td>Asphalt cement and asphalt concrete</td>
<td>Lectures/Reading material</td>
<td>Week 8</td>
</tr>
<tr>
<td>7</td>
<td>Classification and stress analysis of pavement</td>
<td>Lectures/Reading material</td>
<td>Week 9</td>
</tr>
<tr>
<td>8</td>
<td>Pavement design consideration</td>
<td>Lectures/Reading material</td>
<td>Weeks 10</td>
</tr>
<tr>
<td>9</td>
<td>Design of flexible pavement</td>
<td>Lectures/Reading material</td>
<td>Week 11</td>
</tr>
<tr>
<td>10</td>
<td>Design of rigid pavement</td>
<td>Lectures/Reading material</td>
<td>Week 12</td>
</tr>
</tbody>
</table>

**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>60%</td>
<td>• Quizzes • Examinations</td>
<td>• 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</td>
</tr>
<tr>
<td>Application of knowledge</td>
<td>20%</td>
<td>• Quizzes • Project</td>
<td>• 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</td>
</tr>
<tr>
<td>Professional capacity / autonomy</td>
<td>5%</td>
<td>• Project</td>
<td>• 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</td>
</tr>
<tr>
<td>Communication skills</td>
<td>15%</td>
<td>• Project • Labs</td>
<td>• Ability to communicate (oral and/or written) ideas, issues, results and conclusions clearly and effectively</td>
</tr>
</tbody>
</table>
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>Midterm Exam</td>
<td>Topics 1 - 5</td>
<td>March 04</td>
<td>20%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>Topics 6, 8, 10, and 11</td>
<td>TBD</td>
<td>10%</td>
</tr>
<tr>
<td>Attendance</td>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Term project and lab reports</td>
<td>All topics</td>
<td>April 01</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>All topics</td>
<td>TBD</td>
<td>45%</td>
</tr>
</tbody>
</table>

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.
- **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.
- **Should a quiz or** test conflict with a religious holiday that a student wishes to observe; the student must inform the instructor of the conflict no later than one week before the scheduled test. For further information on Accommodations for Religious Holidays see: [http://www.uwo.ca/univsec/handbook/appeals/religious.pdf](http://www.uwo.ca/univsec/handbook/appeals/religious.pdf)

ACTIVITIES IN WHICH COLABORATION IS PERMITTED:

- Group project
- Labs and lab reports

ACTIVITIES IN WHICH COLABORATION IS NOT PERMITTED:

- Examinations
- Quizzes

**QUIZZES AND EXAMINATIONS:** Quizzes and a midterm will be conducted during lectures and/or tutorials with a one-week notice. Students who miss a quiz/midterm will get a mark of zero, unless a legitimate absence has been reported and documented **beforehand.** The **closed book midterm test is tentatively scheduled for the week immediately after the reading week.** The **final examination will be 3 hours and** will be **OPEN BOOK** in which class notes and approved handheld calculators may be used.

**TUTORIALS AND LABORATORIES:** Tutorial problems may be assigned but will not be marked and solutions will be posted on the course website. Groups for labs and the design project will be assigned by the instructor and may be revised during the term. Students must attend all laboratories and submit a group report for each lab with the cover page signed by all group members. Late submission will not be accepted, and all group members will receive a grade of zero unless an extension is pre-approved. Lab data as well as lab reports should be used as an integral part in the final report of the design project.
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.

PLAGIARISM CHECKING: Western University uses software for plagiarism checking. Students are required to submit their Laboratory Reports (if applicable) in electronic form for plagiarism checking.

ACADEMIC INTEGRITY: University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning. For more information on scholastic offenses, please see:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf

ATTENDANCE: Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

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 Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

CONDUCT: Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the Instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam and refrain from using electronic devices. On the premises of Western University or at a University-sponsored program, students must abide by the Student Code of Conduct: http://www.uwo.ca/univsec/board/code.pdf

SICKNESS AND OTHER PROBLEMS: Students should immediately consult with the Instructor or Department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see attached). The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

The attachment titled “INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED” is an integral part of this course outline. Students that 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. For more information concerning medical accommodations, please see: http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

Notice: Students are responsible for regularly checking their email, course website (https://owl.uwo.ca) and notices posted outside the Civil and Environmental Engineering Department Office.
**CONSULTATION:** Students are encouraged to discuss problems with their teaching assistant and/or instructor in tutorial sessions. Office hours will be arranged for the students to see the instructor and teaching assistants. Other individual consultation can be arranged by appointment with the appropriate instructor.

**Course Breakdown:** Engineering Science = 50% = 18.9 AU’s, Engineering Design = 50% = 18.9 AU’s