This one-term course integrates material from previous structural analysis and design courses and extends the knowledge and abilities of students in structural behaviour and design. It enables students to understand the behaviour of Reinforced and Prestressed Concrete Structures. In this course, students develop skills for the design of such structures by applying their knowledge of mathematics, science, and engineering while identifying, formulating, and solving structural design problems. The course techniques and skills prepare students for engineering practice. Upon the completion of this course, students will be able to analyze and design the following reinforced concrete elements: two-way slabs, slender columns, bearing walls, basement walls, shear walls, strip footings, spread footings, combined footings, and pile caps. They will also develop ability to design statically determinate prestressed-concrete one-way slabs and beams.

**Calendar Copy:**

Behaviour and design of Reinforced Concrete (RC) and Prestressed Concrete (PC) elements: RC two-way slabs, RC slender columns in non-sway frames, RC bearing walls, RC basement walls, RC shear walls, RC footings, RC pile caps, PC one-way slabs and PC beams.

**Prequisites:**

CEE 2202A/B, CEE 2221A/B, CEE 3347A/B.

**Corequisites:**

None

**Antirequisite:**

None

**Note:** It is the student's responsibility to ensure that all Prerequisite and Corequisite 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 Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

**Contact Hours:**

3 lecture hours/week; 3 tutorial hours/week.
Attendance:

Attendance in lectures and tutorials will be monitored using iClicker. 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. 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.

Students must follow University policies and public health directives, or they will be referred to the Dean, and their actions might be considered a violation of the student Code of Conduct.

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course 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 as determined by the course instructor. In the event that online learning is required, a stable internet connection with working microphone and webcam will be required.

Instructor:

Dr. M. A. Youssef, P. Eng., SEB 3043, email: youssef@uwo.ca

Administrative Support: SEB3005 or civil@uwo.ca

References:

Required: Prepared class notes can be downloaded from the course website (http://owl.uwo.ca).

- Students are responsible for regularly checking their email, and course OWL site (https://owl.uwo.ca). If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Recommended: Concrete Design Handbook, Cement Association of Canada, Ottawa, ON.

Recommended: Reinforced Concrete Design: A Practical Approach, S. Brzev and J. Pao, Pearson Education.

Units:

SI units will be used in lectures, tutorials, and examinations.
Specific Learning Objectives:

At the end of this course, students should be able to:

1. REINFORCED CONCRETE
   a) Design different types of two-way slabs for flexure, one-way shear, and two-way shear (ET2, PA2, D4, CS2, PR1).
   b) Design slender reinforced concrete columns (PA2, D4, PR1).
   c) Design bearing, basement, and shear walls (PA2, D4, PR1).
   d) Structural design of shallow foundations (PA2, D4, CS2, PR1):
      1. Strip footings.
      2. Spread footings.
      3. Eccentrically loaded footings.
      4. Combined footings.
   e) Structural design of pile caps using the sectional method (PA2, D4, CS2, PR1).

2. PRESTRESSED CONCRETE
   a) Acquire knowledge about prestressing techniques, materials, and prestress losses (KB4).
   b) Calculate losses due to friction, anchorage slip, and elastic shortening (KB4).
   c) Design prestress concrete flexural members to satisfy the serviceability and ultimate limit clauses in A23.3 (ET2, PA2, D4, PR1).
   d) Design prestress concrete members to satisfy the shear requirements in A23.3 (PA2, D4, PR1).

The instructor may expand, or revise material presented in the course as appropriate.

General Learning Objectives

E=Evaluate, T=Teach, I=Introduce (Advanced Level)

<table>
<thead>
<tr>
<th>Knowledge Base</th>
<th>I</th>
<th>Engineering Tools</th>
<th>T</th>
<th>Impact on Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>E</td>
<td>Teamwork</td>
<td></td>
<td>Ethics and Equity</td>
</tr>
<tr>
<td>Investigation</td>
<td></td>
<td>Communication</td>
<td>I</td>
<td>Economics and Project Management</td>
</tr>
<tr>
<td>Design</td>
<td>E</td>
<td>Professionalism</td>
<td>I</td>
<td>Life-Long Learning</td>
</tr>
</tbody>
</table>
**Evaluation:**

The final mark will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments &amp; Participation (includes 5% bonus)</td>
<td>15 %</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Quiz (February 14, 2023-1:00 PM to 3:00 PM)</td>
<td>25 %</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Quiz (March 21, 2023-1:00 PM to 3:00 PM)</td>
<td>25 %</td>
</tr>
<tr>
<td>Final Exam</td>
<td>40 %</td>
</tr>
</tbody>
</table>

-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Total 100 % + 5% Bonus

**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. **Students who have failed this course previously 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 cannot be resubmitted.

(b) In accordance with Senate and Faculty Policy, students may be penalised up to 10% of the marks for the improper use of English. Additionally, poorly written work, with the exception, of 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.

1. **Assignments & Participation:**

10% of the mark will be assigned based on the weekly “gradescope.ca” assignments. The additional 5% will be assigned based on your attendance, participation in the lectures and tutorials, and solution of bonus assignments.

2. **Quizzes and Examinations:**

Two 120 minutes quizzes are scheduled during tutorial periods on **February 14** and **March 21**. The quizzes and the final exam are **OPEN BOOK**. Hand-held programmable calculators may be used, but programs and information stored in advance of the examination may not be used.

**Cheating:**

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:

Accommodation and Accessibility:

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

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 http://academicsupport.uwo.ca/accessible_education/index.html.

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. Please turn off your cell phone before coming to a class, tutorial, quiz or exam. On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: https://www.uwo.ca/univsec/pdf/board/code.pdf

Academic Consideration for Absences
Students should immediately consult with the instructor if they have any problems that could affect their performance in the course. The student should seek advice from the instructor regarding how best to deal with the problem. Failure to notify the instructor (or as soon as possible thereafter) will have a negative effect on any appeal.

https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html

Absences from Final Examinations
If you miss the Final Exam, please contact Western Engineering Undergraduate Services as soon as possible. They will assess your eligibility to write the Special Examination.

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

Note: missed work can only be excused through one of the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is not sufficient on its own.
Academic Policies:

The website for Registrarial Services is http://www.registrar.uwo.ca

In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.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).

Support Services:

Please visit the Western Engineering Undergraduate Services webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.eng.uwo.ca/undergraduate/index.html

Students who are in emotional/mental distress should refer to Mental Health at Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

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 sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at https://www.uwo.ca/health/student_support/survivor_support/get-help.html. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Learning-skills counsellors at the Student Development Centre (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/

Additional student-run support services are offered by the USC, https://westernusc.ca/services/.

Consultation:

Students are encouraged to discuss problems with their teaching assistant and/or the instructor. Office hours will be arranged for the students to meet with the instructor and teaching assistants. Other individual consultation can be arranged by appointment.
Course breakdown:

Engineering design = 100%

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