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

CEE 3347A – Reinforced Concrete Design – Course Outline 2025/26

This one-term course integrates material from previous structural analysis and design courses, extending the knowledge and abilities of students in structural behaviour and design. The general objectives are for students to develop an understanding of behaviour and abilities in the design of reinforced concrete (RC). Students apply their knowledge of mathematics, science, and engineering to achieve these objectives by identifying, formulating, and solving structural design problems. The students design structural components to meet current code criteria. The techniques and skills used by the students prepare them for engineering practice. In the laboratory component of the course, students develop the ability to understand aspects of experimental testing and interpret data.

Calendar Copy:
Introduction to reinforced concrete design, including serviceability and ultimate limit states; analysis and design of reinforced concrete beams and one-way slabs for flexure and shear; bar cutoffs in flexural members; deflections; short columns. (0.5 course).

Prerequisites:
CEE 2202a/b, CEE 2221a/b

Antirequisites:
None

Corequisites:
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 they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not receive credit for the course toward their degree if they violate the Prerequisite, Corequisite, or Antirequisite conditions.

Contact Hours:
Three lecture hours/week, three tutorial hours/week, four one-hour laboratory sessions per term.

3 lecture hours/week:
Lecture materials are posted online before the lectures. Reviewing lecture material and attending lecture sessions should take approximately 8 hours per week.

3 tutorial hours/week:
A 3-hour tutorial session will be delivered each week during the scheduled tutorial hours. A graded Gradescope assignment will be completed each week and must be submitted on the Friday following the tutorial.

4 laboratory sessions/term:
Students will be placed in teams and complete a laboratory session four times throughout the term. The course instructor will provide a schedule for laboratory activities.

Instructor:

Professor Maged A. Youssef, P.Eng., SEB 3043
youssef@uwo.ca
Office hours: by appointment

References:

Required: Prepared class notes can be downloaded from the course website. Students are responsible for regularly checking their email and the course site.

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 unit systems will be used in lectures, laboratories, tutorials and examinations.

Specific Learning Objectives:

1. The Design Process:
   a. Recognize structural elements in typical RC structures [KB4].
   b. Recognize the advantages and disadvantages of concrete as a building material [KB4].
   c. Identify the different codes and design standards related to the course [KB4, LL2].
   d. Understand the different design limit states [KB4].
   e. Know the requirements to satisfy the strength and serviceability limit states [KB4].
   f. Compute and sketch the distribution of maximum moments and shear forces for simple structures, considering all potential loading cases [PA2].
2. Properties of Concrete and Reinforcing Bars:
   a. Know the simplified material constitutive relationships for concrete and steel [**I3**, ITW1, CS3].
3. RC Beams: Flexural Behaviour and Design:
   a. Develop an understanding of the flexural behaviour of RC beams [**I3**, ITW1, CS3]
   b. Calculate the moment capacity of a given beam section [PA2].
   c. Identify the expected failure mechanism for a given beam section [PA2].
   d. Calculate balanced section properties [KB4].
   e. Design rectangular beam sections [**D4**].
   f. Design T and L beam sections [**D4**].
   g. Design beams with compression reinforcing bars [**D4**].
   h. Sketch the designed beam sections that satisfy the skin reinforcements and crack control conditions [D4].
4. Development, Anchorage, and Splicing of Reinforcing Bars:
   a. Calculate the required tension and compression development lengths [PA2].
   b. Calculate the length of bars being curtailed in flexural members [PA2].
5. RC Beams: Shear Behaviour and Design:
   a. Develop an understanding of the shear behaviour of RC beams [**I3**, ITW1, CS3]
   b. Calculate the shear capacity for a given section [PA2].
   c. Design a concrete beam to satisfy A23.3 shear requirements [D4].
6. Continuous Beams and one-way slabs:
   a. Sketch the moment and shear force diagrams for continuous beams and one-way slabs using A23.3 approximate values [KB4].
   b. Sketch the free-body diagrams for slabs and beams of a given structural system [PA2].
   c. Perform detailed design of one-way slabs and beams [**D4**].
   d. Sketch reinforcing bar details for slabs and beams [**D4**].

7. Short Columns:
   a. Develop an understanding of the flexural behaviour of short columns [**I3**, ITW1, CS3]
   b. Sketch an approximate interaction diagram for a given section [PA2].
   c. Design of RC columns using interaction diagrams in the design aids [D4].
8. Deflections:
   a. Calculate deflections of RC beams and slabs [PA2].

The instructor may expand or revise the course material as needed.

General Learning Objectives:

E=Evaluate, T=Teach, I=Introduce; (Developing level)

Knowledge Base	T	Engineering Tools		Impact on Society	
Problem Analysis	T	Team Work	I	Ethics and Equity	
Investigation	E (D)	Communication	I	Economics and Project Management	
Design	E (D)	Professionalism		Life-Long Learning	I

Accreditation Units:

Engineering design = 100%

Evaluation:

The final course grade will be determined as follows:

Assignments	10 %
Participation (Bonus)	05%
Four Lab Reports	20 %
Midterm Exam	25 %
Final Examination	45 %
Total	100 %

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

(c) **Students who have failed this course previously must repeat all components of the course**. No special permissions will be granted to enable a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted.

1. Final Exam:

   A three-hour, open-book final examination will be administered during the designated examination period.

2. Midterm Exam

   An open-book midterm exam is scheduled for October 21st and will last two hours. The exam will assess the material discussed in the weeks leading up to the exam date. **Academic consideration will not be given for this assessment without the submission of appropriate documentation.**

3. Lab Reports:
   Each team of students will submit one report for each of the four labs. The reports should describe the tests conducted and provide a detailed analysis of the results. The reports must be submitted on gradescope.ca within seven days following the laboratory.

4. Participation:
   Participation will be assessed based on class attendance, participation in lectures, tutorials, and labs, and completion of bonus assignments.

5. Weekly Assignments:
   The platform "gradescope.ca" will be utilized to submit assignments throughout the course. Assignments will be made available weekly during the tutorial sessions. Students should submit their completed assignments through the platform before the specified due dates.

I. Missed/Late Accommodation Policy:

1. Students missing an assignment, lab, midterm, or examination will report the absence by submitting an Academic Consideration Request form through the STUDENT ABSENCE PORTAL.
2. Documentation must be provided as soon as possible.
3. Absence from a lab session without a valid reason will result in a **20% mark deduction** from the related lab report.
4. No makeup exam will be offered for the midterm. If a student misses the midterm for a valid reason, their final exam score will account for 70% of the overall course grade.

II. Final Exam Accommodation:

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

III. Late Assignments:

1. Students must advise the course instructor if they have difficulty completing an assignment on time (before the due date).
2. Students should be prepared to submit the Academic Consideration Request Form and provide documentation if requested to do so by the course instructor (see reverse side for information on documentation).
3. This course has 11 assignments, with only 10 assignments counted towards your final grade. Academic consideration will not be granted for missed assignments. If students miss one assignment, the remaining ten will be used to calculate the final grade. If students miss more than one assignment, they will receive a grade of zero on each missed assignment.
4. The assignment deadlines can be found on the platform "gradescope.ca." Students are expected to submit each assignment by the deadline listed. If you have a long-term academic consideration, please contact your instructor at least one week before the posted deadlines.

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

IV. Medical Accommodation:

1. Requests for Academic Consideration Request Form through the 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 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, the instructor, in consultation with the academic advisor, will determine the appropriate academic consideration, if granted, in a manner consistent with the course outline. Academic consideration may include the extension of deadlines, waiver of attendance requirements for classes, labs, or 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.

Such students are responsible for informing themselves concerning the work done in classes from which they are absent and taking appropriate action.

VI. Academic Integrity:

In the Faculty of Engineering, we encourage students to cultivate a culture of honesty, trust, fairness, respect, responsibility, and courage, which benefits their professional development.

Please visit Academic Integrity Western Engineering for more information.

VII. Academic Offences:

Plagiarism refers to the act of using another's work without proper attribution or 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 for the coursework; a repeat offence will earn you zero for 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 borrow an idea or passage from another author, they must acknowledge their debt by using quotation marks where appropriate and by providing 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 using commercial plagiarism detection software licensed to the University to detect plagiarism. All papers submitted will be included as source documents on the reference database to detect plagiarism in papers subsequently submitted to the system. Use of the service is subject to the licensing agreement 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 Faculty of Engineering will not discourage the use of generative Artificial Intelligence (GenAI) tools. As we pride ourselves on building the future, we cannot ignore the use of GenAI tools to contribute to our understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course must be disclosed as a resource.
GenAI tools will not be permitted in any examination or other assessments where the Faculty has prohibited their use. If the instructor detects GenAI tools in these instances, academic offence penalties might be imposed against the student.

IX. Use of English Policy:

Under Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of the English language. 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 who study, visit, and work at Western. As part of this commitment, various services, groups, and committees on campus are devoted to promoting accessibility and ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all campus community members, 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. Please visit Academic Support & Engagement -Academic Accommodations for a more detailed explanation.

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 an 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, and brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistance, please visit Thames Hall, Room 2170, or call 519-661-3030. The crisis clinic operates between 11:00 a.m. and 4:30 p.m. 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 schedule an appointment, please email 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