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

CEE 3347a – Reinforced Concrete Design - Course Outline 2020/2021

This one-term course integrates material from previous structural analysis and design courses and extends the knowledge and abilities of the students in structural behaviour and design. The general objectives are for students to develop an understanding of behaviour, and to develop abilities in design of reinforced concrete (RC). To achieve these objectives, students apply their knowledge of mathematics, science, and engineering while 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 abilities in understanding aspect of experimental testing as well as interpreting 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
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.

Instructor: Dr. M. A. Youssef, P. Eng., SEB 3043, email: youssef@uwo.ca
Administrative Support: Sandra McKay (smckay@uwo.ca)

Textbook:
Required: Prepared class notes can be downloaded from the course website (http://owl.uwo.ca) and the course site on Microsoft Teams.
Contact Hours: 3 lecture hours/week, 3 tutorial/laboratory hours/week

Lectures, laboratories, and tutorials will be delivered asynchronously through pre-recorded videos posted to the course OWL site. The course will be organized into learning modules, which students should review on a weekly basis. Quizzes at the end of each lecture and tutorial module will be used to track participation. The scheduled lecture and tutorial time will be utilized for office hours to answer student questions.

Computing:

Students are required to use personal computers running a Windows environment.

Units:

SI units will be used in lectures and examinations

Specific Learning Objectives:

1. The Design Process:
   a) Recognize structural elements in typical Reinforced Concrete structures.
   b) Recognize advantages and disadvantages of concrete as a building material.
   c) Identify the different codes and design standards related to the course.
   d) Understand the different design limit states.
   e) Know the requirements to satisfy the strength and serviceability limit states.
   f) Compute and sketch the distribution of maximum moments and shear forces for simple structures considering all potential cases of loading.

2. Properties of Concrete and Reinforcing Bars:
   a) Know the actual and simplified material constitutive relationships for both concrete and steel.

3. Reinforced Concrete Beams: Flexural Behaviour and Design:
   a) Calculate the moment capacity of a given beam section.
   b) Identify the expected failure mechanism for a given beam section.
   c) Calculate balanced section properties.
   d) Design rectangular beam sections.
   e) Design T and L beam sections.
   f) Design beams with compression reinforcing bars.
   g) Sketch the designed beam sections that satisfy the skin reinforcements and crack control conditions.

4. Development, Anchorage, and Splicing of Reinforcing Bars:
   a) Calculate the required tension and compression development lengths.
   b) Calculate the length of bars being curtailed in flexural members

5. Reinforced Concrete Beams: Shear Behaviour and Design:
   a) Calculate the shear capacity for a given section.
   b) Design a concrete beam to satisfy A23.3 shear requirements.

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.
b) Sketch the free body diagrams for slabs and beams of a given structural system.
c) Perform detailed design of one-way slabs and beams.
d) Sketch reinforcing bar details for slabs and beams.

7. Short Columns:
   a) Sketch an approximate interaction diagram for a given section.
   b) Design of reinforced concrete columns using interaction diagrams in the design aids.

8. Deflections:
   a) Calculate deflections of reinforced concrete beams and slabs.

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

General Learning Objectives

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

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<th>Problem Analysis</th>
<th>T</th>
<th>Teamwork</th>
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<tr>
<td>Engineering Tools</td>
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Evaluation:

The final course mark will be determined as follows:

- Participation in Tutorials and Lectures 15%
- Four Lab Reports 20%
- Quiz 15%
- Written Final Exam 40%
- Oral Final Exam 10%

Total 100%

Note:  (a) 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 marks from previous years.

(b) If the quiz conflicts with a religious holiday that a student wishes to observe, the student must inform the instructor of the conflict no later than two weeks before its scheduled date.

(For further information on Accommodations for Religious Holidays see
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf)

1. Participation in Tutorials and Lectures:

Mark will be assigned based on the posted quizzes for tutorials and lectures. Students must submit these quizzes by Friday of the week of the tutorial and lectures (page 6 of this document).
2. Laboratories:

Four laboratories allow the students to observe experiments that evaluate:
Lab 1: mechanical properties of concrete and steel.
Lab 2: flexural performance of reinforced concrete (RC) beams
Lab 3: shear behaviour of RC beams
Lab 4: capacity of eccentrically loaded RC columns.

Videos of the conducted tests as well as the experimental measurements will be posted on the course OWL site according to the weekly schedule. Students will be divided into groups and each group of students will submit one report for each of the labs. The reports should describe the conducted tests and provide detailed analysis of the results. The reports must be submitted by the dates specified on the weekly schedule.

Although it is expected that the lab mark will be the same for all group members, students can individually recommend in writing, with stated reasons, a suitable allocation of the report mark. The course instructor reserves the responsibility for making the final allocation. The mark for group work will then be allocated to the members in proportion to each member's contribution to the work.

3. Quizzes and Examinations:

One 120 minutes quiz is scheduled on October 26th during the tutorial time. The quiz and the final exam are take-home exams.

Following the quiz, students might be required to have a follow up oral exam to eliminate or confirm doubts about cheating, which are raised during the marking process.

The written final examination, which will be held during the scheduled final exam period, will be followed by an oral examination, which will include reviewing and discussing the student solution, as well as discussing topics covered in the course.

4. Use of English

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.

Plagiarism Checking:

The University of Western Ontario uses software for plagiarism checking. Students are required to submit their Laboratory Reports in electronic form to Turnitin.com for plagiarism checking.

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

Any student who, in the opinion of the instructor, has not engaged sufficiently in 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.

**Accommodation:**

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: Academic Accommodation for Students with Disabilities.

**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.

**Academic Consideration for Student Absence**

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see

Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

**Religious Accommodation**

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course
requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar.

**Use of Recordings:**
All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

**Conduct:**
Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- please “arrive” to class on time
- please use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- to minimize background noise, kindly mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- please be prepared to turn your video camera off at the instructor’s request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor and/or the course TAs will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- if you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question
- remember to unmute your microphone and turn on your video camera before speaking
- self-identify when speaking.
- remember to mute your mic after speaking

General considerations of “netiquette”:

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.
- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. “Flaming” is never appropriate.
- Be professional and scholarly in all online postings. Cite the ideas of others appropriately.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.
Online Proctoring Notice:
Tests and examinations in this course will be conducted using the remote proctoring service, Proctortrack. 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. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link:

https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf

Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. Information about the technical requirements are available at the following link:

https://www.proctortrack.com/tech-requirements/

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.

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

Notices:
Students are responsible for regularly checking their email, and course website (https://owl.uwo.ca).

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

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.
## CEE3347a – 2020/2021 (Weekly Schedule)

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<th>Lecture Videos</th>
<th>Tutorial Videos</th>
<th>Submissions &amp; Quiz</th>
<th>Lecture Time</th>
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<td>14/9-18/9</td>
<td>Structural Analysis</td>
<td>Lab 1 and Structural Analysis</td>
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<td>Zoom meetings</td>
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<td>with Dr. Youssef</td>
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<tr>
<td>21/9-25/9</td>
<td>One-way Floor Systems</td>
<td>Structural Analysis</td>
<td>Lab 1 report</td>
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<td>Zoom meetings</td>
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<td>due 23/9</td>
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<tr>
<td>28/9-2/10</td>
<td>Flexural Design</td>
<td>One-way Floor Systems</td>
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<tr>
<td>5/10-9/10</td>
<td>R sections Design</td>
<td>R section Analysis</td>
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<td>14/10-16/10</td>
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<td>R section Design</td>
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<td>19/10-23/10</td>
<td>Compression Steel</td>
<td>Design of slabs and beams</td>
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<tr>
<td>26/10-30/10</td>
<td>Cracking and Shrinkage</td>
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<td>Quiz</td>
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<tr>
<td>9/11-13/11</td>
<td>Detailing</td>
<td>Lab 2 &amp; Design of slabs and beams</td>
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<tr>
<td>16/11-20/11</td>
<td>Shear Strength</td>
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<td>23/11-27/11</td>
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<td>Due 9/12</td>
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1 Dates might change, and the actual schedule may not exactly follow this schedule.