This course covers selected design topics that are needed for engineers to pursue a profession as structural engineers. The course extends students' knowledge and abilities in structural behaviour and design of different lateral load structural systems.

The general objectives are for student to be able to:

- Understand and quantify the behaviour of buildings with lateral resisting systems consisting of shear walls, frames, and wall-frame systems.
- Understand three-dimensional modelling aspects and techniques.
- Design concrete shear walls and rigid frames under lateral loads in accordance with the provisions of CSA standards CAN/CSA A23.3-14.
- Design wood shear walls and diaphragms under lateral loads in accordance with the provisions of CSA standards CAN/CSA O86-14.
- Design masonry shear walls under lateral loads in accordance with the provisions of CSA standards CAN/CSA S304.1-04.
- Introduce students to selected engineering case studies covering modern lateral load structural system of worldwide famous high-rise buildings.

Calendar Copy:

This course covers the analysis and behaviour of high-rise buildings with lateral resisting systems consisting of shearwalls, rigid frames, and wall-frame systems; design of concrete shearwalls and rigid frames; analysis and design of light-framed wood shearwalls and diaphragms; design of masonry shearwalls under lateral loads. Several case studies developed for some worldwide famous high-rise buildings are discussed during the course. Three-dimensional computer modelling of high-rise buildings are covered.

Prerequisites:

CEE 3343A/B and CEE 3347A/B

Antirequisites:

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:

2 lecture hours per week
Monday: 11:30-1:30 am at SEB-3109
Lectures will be delivered in-class during lecture time slots and recorded. Recorded lectures will be posted afterwards to the course OWL site. Lectures will be organized into learning modules which students should review on a weekly basis. Review of lecture material and self-study should take approximately 4 hours per week.

2 hours/week Tutorial and office hours
Monday: 2:30- 4:30 pm at ACEB-1400 and ACEB 1415
A 2-hour tutorial session will be delivered synchronously through Zoom each week during the scheduled tutorial hours. Tutorials are not mandatory but students seeking assistance with weekly assignments or clarification on lecture material are strongly encouraged to attend. The link to the Zoom meeting will be posted to OWL.

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 participating in the course for their private or group study purposes. 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 by instructor in writing, or the participant has the prior written permission of the instructor for this specific course during this specific semester.

Instructor:
Dr. Ahmed (Mahdy) Hamada, P.Eng., SEB 3117
email: ahamada2@uwo.ca
Office hours: TBA via Zoom (or similar alternative) (link will be posted on course OWL site)

Administrative Assistant: Sandra McKay (smckay@uwo.ca)
Teaching Assistant:

TBA

Textbook:

Prepared class notes shall be uploaded to OWL and brought to all lectures and tutorial sessions.

Other references:

List of books

Concrete Design Handbook (Third Edition) 2014, Cement Association of Canada, Ottawa, ON, Canada

Wood Design Manual 2015 – Canadian Wood Council CWC 2015 and Canadian Standards Association, Mississauga, ON, Canada


The above references will be on hold in Taylor library, and will be available for one-day borrowing.

Computing:

Final project and assignments involve computer modelling of high-rise building using the commercial program ETABS, S-Concrete, S-Timber, MASS, spread sheets, and writing report. The full versions of software are available at the PC labs in the engineering building or through online access as per the Faculty of Engineering-IT procedures (please consult with Faculty of Engineering IT for granting access to these software).

Specific Learning Objectives:

1. Lateral systems for buildings. At the end of this section, the student should be able to:
   a. Recognize different types of structural systems used to provide lateral resistance for high-rise buildings.
   b. Identify the suitable system for each building.
   c. Understand the interaction between frames and shear walls subjected to lateral load.
   d. Understand three-dimensional modelling aspects and techniques and learn how to model structures using commercial software ETABS.
2. Design of concrete lateral loads structural systems in accordance with the provisions of CSA standards CAN/CSA A23.3-14
   a. Design of shear walls
b. Design of rigid frames
   c. Typical reinforcement details for concrete shear walls and rigid frames
3. Design of wood lateral load structural systems in accordance with the provisions of CSA standards CAN/CSA O86-09:
   a. Understand the design concepts of limit state design method
   b. Design of wood
      i. Light-framed Wood Shear walls
      ii. Floor diaphragms
4. Design of masonry lateral load structural systems in accordance with the provisions of CSA standards CAN/CSA S304.1-04:
   a. Recognize different types of masonry building systems
   b. Recognize different types of masonry construction
   c. Design of masonry Shear walls
5. Case studies of high-rise buildings
   a. Study and analyze several case studies developed for some worldwide famous high-rise buildings.
   b. Examine several case studies in which some critical engineering decisions and judgement must be made

**General Learning Objectives:**

E = Evaluate, T = Teach, I = Introduce

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

The final mark will be determined as follows:

<table>
<thead>
<tr>
<th>Assignments</th>
<th>40%</th>
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<tbody>
<tr>
<td>2 Quizzes (Open Book)</td>
<td>30%</td>
</tr>
<tr>
<td>Group Project – Max. 3 Students/group (Building Analyses &amp; Design)</td>
<td>30%</td>
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<tr>
<td><strong>Total</strong></td>
<td>100%</td>
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Note: 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.
## Project breakdown

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Layout of Suggested Structural System</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Final Project Portfolio:</strong></td>
<td></td>
</tr>
<tr>
<td>- Cover Letter</td>
<td>10%</td>
</tr>
<tr>
<td>- Design Brief</td>
<td>10%</td>
</tr>
<tr>
<td>- Calculations</td>
<td>20%</td>
</tr>
<tr>
<td>- Drawings</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Oral discussion and Defence of design</strong></td>
<td>35%</td>
</tr>
</tbody>
</table>

## Notes

### Oral discussion and Defence of design
Each group will give a 5 to 10 minutes presentation on their project followed by an oral discussion and defence of the design. Each student is required to be fully aware of all aspects of the final project, such as analyses, design, and drawings. Some of the questions shall be asked individually to any of the group members, and others to the whole group. Each individual member of the group might receive different mark based on the oral discussion.

### Final Project Portfolio
**Cover letter and Design Brief**
The length of the final design brief shall not exceed 10 typed pages (font size 12, double spaced is preferable). Suggested contents are: Cover Letter, Executive Summary; Introduction, Design Criteria, particulars of design/analysis, and Recommendations (or Conclusions). The Design Criteria would include the design standards and technical references used; the particular design criteria adopted also must be indicated succinctly. The particulars of design/analysis would summarize the rationale behind the various design decisions. The evaluation of the final design brief shall be based on the format, layout, completeness, technical content and use of English.

**Calculations**
Calculations must be well organized, clear, complete, and done on calculation paper. Each calculation page shall be dated, and shall indicate the name or initials of the person who performed the calculations. A final calculation set, which must be current, checked and indexed, shall be submitted with the final design brief. The evaluation of calculations will be based on their clarity, completeness, technical content, originality, and accuracy.

**Drawings**
Each student is required to prepare a set of drawings. Each drawing shall be dated, and shall indicate the name or initials of the person who did the drawing. The evaluation of drawings will be based on their technical content, clarity, completeness, and quality of drafting. Hand Sketches are not accepted. Drawings are to be prepared using AutoCAD or REVIT.
Quizzes and Examination:

Two One-hour quizzes will be held during tutorial hours. These quizzes are tentatively scheduled for Monday, October 19 and Monday, November 23, 2020.

Take-home written quizzes will be held during these tentative dates shown above with an oral component of exam via Zoom (or similar alternatives). Written part is 50% of the quiz mark and Oral exam part is 50% of the quiz mark. All students must do both written and oral parts. The quizzes grade based on written responses might be adjusted according to the oral exam outcome.

Assignments:

Each student must turn in the solution of the assignment at 5:00 pm Friday Afternoon electronically on OWL. Hardcopy submissions are not accepted unless permission is granted by the instructor. Late assignment will be accepted till 5:00 pm on the Monday following the submission date and have to be submitted directly to the instructor. Late assignments will be assessed a penalty of 10% per day, to a maximum of 4 days, after which they will receive a mark of zero. Extensions are to be negotiated with the course instructor, not the teaching assistants.

Use of English:

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

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.

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:

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: http://www.uwo.ca/univsec/board/code.pdf

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
- [suggested for classes larger than 30 students] In order to give us optimum bandwidth and web quality, please turn off your video camera for the entire class unless you are invited to speak
- [suggested for cases where video is used] 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 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 and turn off your video camera after speaking (unless directed otherwise)

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.

**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.

**Online Proctoring Notice:**

1. If using Zoom Only:

Tests and examinations in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will not be recorded.*
More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link:


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

https://support.zoom.us/hc/en-us.

* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please discuss this with your instructor in advance of the test or examination.

**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 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 Science = 25% AU’s, Engineering Design = 75% AU’s

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