Instructor:
Dr. Georgios Balomenos
Office: ITB A318
Email: balomeng@mcmaster.ca
Office Hours: Mon., Wed., 2:30-3:30pm

Teaching Assistant:
TBA
Office: TBA
Email: TBA
Office Hours: TBA

Lectures: 3 hours/week: Mon., Wed., 1:30-2:20pm BSB-B103
Thurs.
Tutorials: 2 hours/week: Tues., Fri. 2:30-3:20pm JHE-A102

Website: Avenue to Learn (http://avenue.mcmaster.ca)
It is the responsibility of the students to check Avenue regularly.

Course Content:
This course will serve as an introduction to seismic and lateral load design principles. Topics covered (depending on available time) include:

- **Seismic design code**
  - Load combinations
  - Strength and drift requirements

- **Ductility and capacity design concepts**
  - Code R factors
  - Collapse mechanisms

- **Seismic design/detailing for concrete buildings**
  - Moment resisting frames
  - Shear walls

- **Seismic design/detailing for steel buildings**
  - Moment resisting frames
  - Braced frames (Concentrically and Eccentrically)
Learning Outcomes:

- Be able to calculate earthquake forces on and design key components of various lateral load resisting system.
  - 2.2 Ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem.
  - 4.1 Recognizes and follows an engineering design process.
  - 4.2 Recognizes and follows engineering design principles.
  - 4.3 Obtains experience with open-ended problems.
  - 7.2 Presents instructions and information clearly and concisely.
- Be able to articulate desired/expected behaviour of a structure under various hazard levels
  - 8.1 Understands the role of the engineer in society, especially in protection of the public and public interest

Course Calendar:
This schedule is provided as a rough guide and may change slightly depending upon the pace of lectures.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topics (subject to change)</th>
<th>Due Dates (subject to change)</th>
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<tbody>
<tr>
<td>Jan 7</td>
<td>Seismic design code concepts</td>
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<tr>
<td>Jan 14</td>
<td>Ductility and capacity design</td>
<td>Jan 18: Assignment 1</td>
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<tr>
<td>Jan 21</td>
<td>RC review</td>
<td>Jan 25: Assignment 2</td>
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<tr>
<td>Jan 28</td>
<td>Concrete moment frames</td>
<td>Feb 1: Assignment 3</td>
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<tr>
<td>Feb 4</td>
<td>Concrete moment frames</td>
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<tr>
<td>Feb 11</td>
<td>Concrete shear walls</td>
<td>Feb 11: Assignment 4</td>
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<tr>
<td>Feb 18</td>
<td>No Classes or Tutorials</td>
<td>Mar 1: Assignment 5</td>
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<tr>
<td>Feb 25</td>
<td>Concrete shear walls</td>
<td></td>
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<tr>
<td>Mar 4</td>
<td>Steel moment frames</td>
<td>Mar 6: Midterm Exam</td>
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<tr>
<td>Mar 11</td>
<td>Steel moment frames</td>
<td>Mar 20: Assignment 6</td>
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<tr>
<td>Mar 18</td>
<td>Steel braced frames</td>
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<tr>
<td>Mar 25</td>
<td>Steel braced frames</td>
<td></td>
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<tr>
<td>Apr 1</td>
<td>Dynamic analysis methods</td>
<td>Apr 1: Assignment 7</td>
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<td>Apr 8</td>
<td>Course review</td>
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**Required Textbook:**

- Students are expected to have the *CAC Concrete Design Handbook* and the *CISC Handbook of Steel Construction*.
- Necessary portions of the *National Building Code of Canada* (NBCC), also available in the design lab, will be provided.
- The book *Elements of Earthquake Engineering and Structural Dynamics* 3rd Ed by Andre Filiatrault, et al. (2013) is a great reference (based on the 2010 NBCC) and it is highly recommended. It is available in the bookstore, and one copy has been placed on reserve in Thode Library.

**Evaluation:**

<table>
<thead>
<tr>
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<th>Percentage</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>5%</td>
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<tr>
<td>Assignments</td>
<td>25%</td>
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<tr>
<td>Project</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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**Note:** The final percentage grade will be converted to a letter grade using the Registrar’s office.

**Class Participation:**

Attendance at all course activities (classes, tutorial sessions, exams) is mandatory. The tutorials will be used for peer-led examples, software tutorials, and question and answer sessions. They may also be used for additional course activities (classes, exams). You will be notified in advance when this will occur. **Phones may not be used during classes or tutorials.**

**Assignments:**

- Due dates will be indicated on the assignment sheets. **Late assignments will not be accepted.**
- Minimum standards of neatness will be expected for all assignments. These standards include neat, legible printing, use of a straight edge for straight lines,
and use of an eraser to correct mistakes. Assignments will be returned UNMARKED if these standards are not met.

- Assignments are to be individual effort. *Excessive collaboration* on an assignment may constitute a violation of the McMaster Academic Integrity Policy (Appendix 3).

- **Definition of excessive collaboration:**
  - Discussing an assignment in significant detail with peers or splitting up work.
  - Using a classmate’s assignment as the basis or as a reference for your own, or allowing someone else to do this with your assignment.
  - Sharing computer code, spreadsheet file, etc., to be submitted as part of an assignment.

- **How to avoid excessive collaboration:**
  - Do not discuss assignment solutions with classmates in step-by-step detail.
  - Do not show or give your assignment solution to another student.
  - Write up your solution separately from your classmates.
  - If you work with someone else or receive assistance, please indicate this and the name(s) of the person(s) involved on your assignment.

| Note: | Unclaimed assignments will be kept for a period of one (1) month past the final exam date after which they will be destroyed by secure shredding. |

**Project:**

There will be four major structural systems discussed in this course: concrete moment frames, concrete shear walls, steel moment frames, and steel shear walls. **The class will be divided into four groups.** Each group will:

- Be assigned **one of the systems**.

- Give a **20-30 minute presentation** discussing the system. You should outline: (1) the force transferring mechanisms of the systems for both gravity and lateral loads (talk us through the shear and bending moment diagrams), (2) the capacity design philosophy for the system, (3) the design process for the system.

- Complete a **homework design of the system** but use the ‘project location’ to find your lateral design forces. This design will be presented in a meeting with Dr. Balomenos before the system is formally discussed in class.
• **Lead two tutorial sessions**, outlining your design process and answering questions from the class.

After completing all of the above each student should email Dr. Balomenos giving the percentage of contribution of each group member (e.g., for a group of 4 each person gets 25% if all participate equally). If your group members rank your participation as low, **your score will be affected**. More details will be discussed in class.

**Note:** Everyone in your group should present either in the class presentation or in the tutorial session.

**Midterm Exam:**

• Limited Open Book (CAC Handbook and CISC Handbook) and specified documents only.

• One (1) 8.5 x 11 in. (double-sided) “formula sheet” and McMaster Standard Calculator (Casio fx-991 MS or MS Plus) will be permitted.

• **If you miss the midterm**, points will be transferred to the Final Exam if you have filed an MSAF ([https://www.mcmaster.ca/msaf/](https://www.mcmaster.ca/msaf/)) within 48 hours of the test. Otherwise a mark of ZERO will be given.

• **If you do not do well on the midterm**, and do better on the final, the weight of the midterm will be transferred to the final.

**Final Exam:**

• The final examination will be scheduled by the Registrar.

• Limited Open Book (CAC Handbook and CISC Handbook) and specified documents only.

• One (1) 8.5 x 11 in. (double-sided) “formula sheet” and McMaster Standard Calculator (Casio fx-991 MS or MS Plus) will be permitted.
McMaster University Policies

Academic Integrity: In order to maintain a culture of academic integrity, members of the McMaster University community are expected to promote honesty, trust, fairness, respect and responsibility. You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that result or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonest”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. [Check https://www.mcmaster.ca/academicintegrity/ for more information.]

The following illustrates only three forms of academic dishonesty:

- Plagiarism
- Improper collaboration in group work
- Copying or using unauthorized aids in tests and examinations

Accommodation for Students with Disabilities: The Student Accessibility Services (SAS) located in McMaster University Student Centre (MUSC), Room B107, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the Student Accessibility Services office at the beginning of each academic term. The Student Accessibility Services can be contacted by phone 905-525-9140, ext. 2865 or e-mail sas@mcmaster.ca. [Check https://sas.mcmaster.ca/ for more information.]