### Topics Covered:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1. | Introduction  
  - history of concrete  
  - constituents of reinforced concrete, portland cement, hydration |
| 2. | Material Properties  
  - steel, concrete tensile and compressive response  
  - time-dependent properties: shrinkage, thermal and creep effects |
| 3. | Behaviour of Axially-Loaded Elements  
  - axial load-axial deformation response  
  - short-term and long-term properties |
| 4. | Members in Flexure  
  - moment-curvature response, uncracked and cracked response  
  - rectangular stress blocks, linear-elastic simplifications |
|   | Midterm #1  
  Wednesday, February 15 |
| 5. | Design of Reinforced Concrete Beams  
  - limit-states design  
  - nominal flexural capacity, factored flexural resistance  
  - tension, compression and balanced failures  
  - doubly-reinforced sections, T-sections, one-way slabs  
  - cracking, durability considerations |
| 6. | Deflections  
  - effective moment of inertia  
  - instantaneous and long-term deflections, deflection limits |
| 7. | Shear Design of Reinforced Concrete Beams  
  - shear stresses in uncracked and cracked beams  
  - variable-angle truss model  
  - CSA A23.3 methods of shear design |
| 8. | Bond and Development of Reinforcement  
  - development length, bond stresses, radial stresses, splitting  
  - hooked anchorages  
  - development of reinforcement in continuous members and design of bar cutoffs |
| 9. | Short Columns  
  - types of columns  
  - strength of axially-loaded columns and columns subjected to combined axial load and bending  
  - design of columns, interaction diagrams |
|   | Midterm #2  
  Wednesday, March 22 |
| 10. | Footings  
  - types of footings  
  - structural actions, soils pressures and distribution, kern distance |
| 11. | Analysis of Reinforced Concrete Structures  
  - moment-area theorems, force method, moment distribution  
  - approximate methods: portal, cantilever and Muto methods |

Note: topics may be added or modified as the term progresses
**Required Text:**
*Concrete Design Handbook*, Cement Association of Canada (available for purchase in ME 3432)
Cost = $190.00 through academic discount

**Useful Textbook:** (can be ordered through bookstore or purchased online)

**Referenced Textbooks:**

**Mark Breakdown:**
- Assignments 20% (About 10 total, approximately 1 per week)
- Midterm Exams 2 x 12.5%
- Final Exam 55%

Assignments must be completed entirely in pencil either on engineering computation paper or graph paper. Assignments must be neat, clear and of professional quality. Drawings are to be done by hand and drawn to scale using appropriate drafting instruments. Each assignment is marked out of 100, and 10 of these marks will assess the assignment’s professionalism. Assignments that are not handed in before due will immediately receive a 50% penalty. Thereafter a penalty of 10% per day will be assessed. The only reasons that will excuse a late assignment are illness documented by a doctor’s note or prior permission from the instructor. Refer to the US Naval Observatory’s Master Clock Time for the official CIVE 3206 time (http://tycho.usno.navy.mil/simplenav.html).

Calculators (regular and programmable) are the only electronic aids permitted during exams. A minimum grade of 40 out of 100 must be obtained on the final exam in order to receive credit for the course.

**General:**
Attendance at lectures and PA sessions is mandatory. The method of teaching in this course is through lectures and the blackboard, as there is no textbook for the course (the CAC Concrete Design Handbook is not a textbook). Handouts that supplement the lecture material will be given out from time-to-time during the term. Experience has shown that there is a direct relationship between regular attendance and the student’s final grade (and can be the difference between a passing or failing mark).

Students are required to check CuLearn and their Carleton email regularly for messages, updates and course content. All electronic devices other than calculators (such as cell-phones, music devices and laptops) are to be turned off prior to lectures.

Students with disabilities should contact the Paul Menton Centre for Students with Disabilities and advise the instructor in person of any accommodations that may be required, at a minimum of two weeks prior to requiring the accommodation. No accommodation will be arranged for until the instructor is advised in person by the student. Students requiring religious accommodations should contact the instructor by email to arrange for prior individual accommodation.