

Carleton University  
Department of Civil and Environmental Engineering

## CIVE 3206 –Design of Reinforced Concrete Components

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**Instructor:** **Ted Sherwood**      ted\_sherwood at carleton dot ca  
Office: ME3366  
Office Hours: Open-door (I am also easily reached by email)

**TA:**                      Waad Subber MC1040  
                                Salah Sarhat ME3359  
                                Qingfei Jia      MC1040

**Lectures:**      Tuesdays and Thursdays      1:05 – 2:25      UC182  
**PA/Lab:**      Alternate Wednesdays      8:35 – 11:25      UC282

**Topics Covered:**

1.	Introduction	-history of concrete -constituents of reinforced concrete, portland cement, hydration
2.	Material Properties	-steel, concrete tensile and compressive response -time-dependant 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 -linear-elastic simplifications -actual behaviour after cracking, rectangular stress blocks
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
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 at the Instructor's discretion

**Required Text:**

*Concrete Design Handbook*, Cement Association of Canada (available for purchase in ME 3432)  
Cost = \$95.00 approx. through academic discount

**Recommended Textbook: (can be ordered through bookstore)**

*Reinforced Concrete: Mechanics and Design (1<sup>st</sup> Canadian Edition)*, J.G. MacGregor and F.M. Bartlett, Prentice-Hall Canada Publishers, Scarborough, Ontario, Canada. 2000. ISBN 013101403-x, 1042 pages.

**Useful Referenced Textbooks:**

*Prestressed Concrete Structures*, M.P. Collins, D. Mitchell, Response Publications, 1997, 766pp.  
(available for purchase through instructor)

*Reinforced Concrete Design (3<sup>rd</sup> Edition)*, S.U. Pillai, D.W. Kirk and M.A. Erki, 1999, McGraw-Hill Ryerson Ltd, Whitby, On, 630 pp. ISBN 0075608294

*Reinforced Concrete Design : a Practical Approach*, S. Brzev and J. Pao, 2006, Pearson Prentice Hall, Toronto, On, ISBN 0130391255

**Mark Breakdown:**

Assignments 30% (About 10 total, approximately 1 per week)

Midterm Exam 20% (Currently scheduled for Wednesday, February 13)

Final Exam 50%

Assignments must be completed in pencil either on engineering computation paper, graph paper or plain paper. Assignments must be neat, clear and of professional quality. Drawings are to be done by hand and in pencil. Assignments that are not handed in when 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 is illness documented by a doctor's note or prior permission from the instructor. Midterm and final exams are open-book and open-notes. Calculators (regular and programmable) are the only electronic aids permitted during exams. A minimum grade of 40% 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 primary method of teaching is through lectures and the blackboard, as there is no textbook for the course (the CAC Concrete Design Handbook is not a textbook). Handouts will be given out from time-to-time during the term.

The course website will be on the MyCarleton Portal ([portal.carleton.ca](http://portal.carleton.ca)). Students are required to check the website 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 (500 University Centre) and advise the instructor by email of any accommodations that may be required. Students requiring religious accommodations should contact the instructor by email to arrange for prior individual accommodation.