

## COURSE INFORMATION

**Course Name:** Reinforced Concrete Design

**Course Code:** CIVENG 3J04

**Session Offered:** Winter 2025

**Calendar Description:** Design by limit states methods to ensure adequate capacities for bending moment, shear and diagonal tension, axial force, bond and anchorage; and design to satisfy serviceability requirements for deflection and cracking; practical design requirements; interpretation of building code for behaviour of structures.

**Pre-Requisites:** CIVENG 3G04: Structural Analysis, CIVENG 3P04: Civil Engineering Materials & Design

**Instructor:** Dr. Mehdi Shafikhani

**Phone:** (647) 501-8114

**Email:** [shafikhm@mcmaster.ca](mailto:shafikhm@mcmaster.ca)

**Office Hours/Contact:** By appointment only

**Class Schedule Days:** Lectures: Mo, We, Th

Time: 5:30 PM – 6:20 PM

**Tutorial:** Th

Time: 10:30 AM – 12:20 PM

**Laboratory:** L01: We 8:30 AM-11:20 AM; L02: We 2:30 PM-5:20 PM

L03: Fr 2:30 PM-5:20 PM; L04: Mo 2:30 PM-5:20 PM

**Teaching Assistants:** Kevin Luong ([luongcn@mcmaster.ca](mailto:luongcn@mcmaster.ca)); Lily Wilson ([wilsol13@mcmaster.ca](mailto:wilsol13@mcmaster.ca)); Mohamed Saleh ([salehm36@mcmaster.ca](mailto:salehm36@mcmaster.ca))

**Required Book:** CAC, Concrete Design Handbook, Canadian Portland Cement Association, 4<sup>th</sup> ed., Ottawa.

Order online at: <https://www.orderline.com/concrete-design-handbook-fourth-edition>

### Recommended Book:

Chaallal, Reinforced Concrete Structures, Design According to CSA A23.3-14, Presses de l'Université du Québec

Brzez & Pao, Reinforced Concrete Design: A Practical Approach, 3<sup>rd</sup> ed., Pearson Learning Solutions, Boston

## 1. COURSE OBJECTIVES

The primary objective of the course is to provide background materials to enable a student to 1) understand the behavior of reinforced concrete structural members (beams, columns, beam-columns, continuous beams and one-way slabs), and 2) successfully design such simple reinforced concrete elements, satisfying strength and serviceability limit states in accordance with CSA-A23.3 Design of Concrete Structures.

Please refer to Section 5 for the Learning Outcomes of this course.

## 2. COURSE SPECIFIC POLICIES

All lectures and tutorials are mandatory.

All email exchanges are to be via McMaster University email accounts (we will not be checking for emails via Avenue). Lecture notes, additional notes and assignments will be posted on Avenue. Students are expected to check and read all the materials posted on Avenue.

Accommodations for missed academic work with a granted relief are as follows:

1. Term test: There will be no makeup test, and the missed test grade portion will be re-allocated to the final examination.

2. Assignments will be extended 48 hours by submitting an approved MSAF form. Late assignment submissions with no granted relief: the assignment grade will be reduced by 30% per each late day. Late assignments that are submitted after 2 days from the deadline will not be accepted.

3. Laboratory: The grades for this course component cannot be re-allocated to any other component (due to an MSAF), because of the unique experimental and practical problem analysis nature of the lab.

The following course schedule is tentative. The instructor and the University reserve the right to modify elements of the course during the term. Any changes you will be announced in class and/or posted on A2L.

### 3. SCHEDULE

WEEK 1	Introduction to design process, codes & standards, loads on buildings etc.	Assignment 1
WEEK 2	Introduction to beam flexural behavior, analysis & design	
WEEK 3	Singly and doubly reinforced rectangular beam analyses	Assignment 2
WEEK 4	Flanged sections analysis	
WEEK 5	Beams under flexure: Design logic and processes	Assignment 3
WEEK 6	Beam shear behavior, analysis & design	Assignment 4
WEEK 7	Column behavior: Introduction & concepts	
WEEK 8	Column behavior & interaction diagrams	
WEEK 9	Column uniaxial and biaxial bending design	
WEEK 10	Slender columns: Serviceability, deflection and crack width calculation	Term Test
WEEK 11	Bond & anchorage of reinforcement: Development length, hooks, bar cut-off	Assignment 5
WEEK 12	Reinforcement detailing	Assignment 6
WEEK 13	Review	
FINAL EXAMINATION	Scheduled during the regular University Final Examination period established by the Registrar's Office	

### 4. ASSESSMENT OF LEARNING

### WEIGHT %

Individual components will be weighted as follows:

Assignments	20%
Term Tests	30%
Laboratory report	10%
Final Exam	40%

Students must obtain at least 50% of the final exam mark to pass the course. Students must obtain at least 50% of the final exam grade, for the assignment marks to be considered towards the final course grade.

Students must safely participate in their specific assigned laboratory at ADL, submit the laboratory report and obtain at least 50% mark on the report to pass the course.

## LECTURES AND TUTORIALS

The classes and tutorials are the primary means for delivering the course material and for regular communication between the instructor/TAs and the class. The lectures will be used to present theoretical background and some illustrative examples. Additional examples will be demonstrated during the tutorials.

### Assignments

The purpose of the assignment problems is to give you an opportunity to develop an in-depth understanding of the course material. All work that you submit for grading must be your own work. Assignments are to be submitted through Avenue to Learn, do not submit assignments by email.

## 5. LEARNING OUTCOMES

**When you have successfully completed this course, you will be able to:**

- Identify and state reasonable reinforced concrete analysis and design assumptions and suitable associated engineering fundamentals, before proposing a solution path to the relevant problem. [CEAB Indicator 2.1]
- propose reinforced concrete analysis and design problem solutions supported by substantiated reasoning, recognizing the limitations of your solutions. [CEAB Indicator 2.2]
- Justify and reflect on analysis and design decisions, giving consideration to limitations, assumptions, constraints and other relevant factors. [CEAB Indicator 4.4]
- Integrate appropriate standards, codes, legal and regulatory factors into relevant decision making. [CEAB Indicator 8.2]

## 6. LABORATORY SAFETY

Each student must prepare their own laboratory report based on their specific lab assignment. Detailed instructions about the laboratory sessions, assignments and requirements will be posted on A2L.

The Faculty of Engineering is committed to McMaster University's Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs and policies". It is your responsibility to understand McMaster University's Risk Management system, which is supported by a collection of Risk Management Manuals (RMMs) that contain programs and policies in support of the Risk Management System. The RMMs are available from

[https://hr.mcmaster.ca/employees/health\\_safety\\_well-being/our-safety/risk-management-manuals-rmms/](https://hr.mcmaster.ca/employees/health_safety_well-being/our-safety/risk-management-manuals-rmms/).

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for specific experiments (see course lab manuals) and the laboratory equipment

[https://www.eng.mcmaster.ca/sites/default/files/civil\\_lab\\_health\\_and\\_safety\\_manual.pdf](https://www.eng.mcmaster.ca/sites/default/files/civil_lab_health_and_safety_manual.pdf)

Additionally, McMaster University's workplace health and safety guidance related to COVID-19 must always be followed (available from <https://hr.mcmaster.ca/resources/covid19/workplace-health-and-safety-guidance-during-covid-19/>).

The safety requirements for all Civil Engineering laboratories are listed below. Students who do not comply with health and safety requirements will not be allowed to participate in the lab.

- Glass or safety glasses/goggles must be worn in the lab at all times
- Contact lenses are not to be worn in the lab.
- No short (i.e. above knee) pants or skirts are permitted in the lab – lab coats must be worn over top of your clothing in these instances.
- CSA-approved Closed-toe shoes with CSA's Triangle Green Patch must be worn at all times.
- No loose clothing allowed.

- Long hair must be tied back.
- Gloves must be worn when working with hazardous chemicals (as indicated by the laboratory instructor).

In addition, the following instructions have been provided for this course by the Applied Dynamics Laboratory supervisor:

- PPE Required: During the lab, students are required to wear CSA-Green Patch safety boots, hard hats, and safety eye-glasses at all times. Students supply their own safety boots. Hard hats and safety-glasses are available in the lab. Prescription eye-glasses are only considered as safety glasses if they have side shields.
- Maintain a safe distance from the universal tester while the sample is being loaded.
- No one will create a situation that could compromise or jeopardize the safety of themselves or anyone else in the lab. Obey all instructions given to you by Teaching assistant and/or lab technical staff.
- These safety requirements are emphasized 1) through a pre-lab form which each student must sign, 2) through lab work instruction sheets, and 3) instructor/TA/technicians check each student to ensure they are wearing the above items.
- Prior to each lab, students are verbally reminded that they should wear the above safety equipment at all times, and in addition lab specific safety instructions are given to students by the instructor/TA/technicians.
- Failure to comply with safety rules, will result in the individual student being denied access to the lab and given a “did not complete” grade for the lab session. In the case of 3J04, this means an automatic F grade.

## 7. COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their “@mcmaster.ca” alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

## 8. POLICIES

### ACADEMIC INTEGRITY

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. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results 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 dishonesty”), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>.

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

### **AUTHENTICITY / PLAGIARISM DETECTION**

**Some courses may** use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity).

### **COURSES WITH AN ON-LINE ELEMENT**

**Some courses may** use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

### **ONLINE PROCTORING**

**Some courses may** use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

### **CONDUCT EXPECTATIONS**

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

### **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

### **REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK**

[McMaster Student Absence Form \(MSAF\)](#): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

The McMaster Student Absence Form is a self-reporting tool for **Undergraduate Students** to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please note, this tool cannot be used during any final examination period. You may submit a maximum of 1 Academic Work Missed requests per term. It is **your** responsibility to follow up with your Instructor immediately regarding the nature of the accommodation. If you are absent more than 5 days or exceed 1 request per term you **must** visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation. This form should be filled out immediately when you are about to return to class after your absence.

#### **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

#### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

#### **PROTECTION OF PRIVACY ACT (FIPPA)**

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades, and all other personal information at all times. For example, the submission and return of assignments and the posting of grades must be done in a manner that ensures confidentiality – see <http://www.mcmaster.ca/univsec/fippa/fippa.cfm>.

#### **ANTI-DISCRIMINATION**

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer, or the Human Rights Consultant, as soon as possible.

[https://www.mcmaster.ca/policy/General/HR/Discrimination\\_and\\_Harassment.pdf](https://www.mcmaster.ca/policy/General/HR/Discrimination_and_Harassment.pdf)

#### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

9. MCMASTER GRADING SCALE		
Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49