McMaster University | ENGINEERING

COURSE OUTLINE

COURSE INFORMATION

Course Name:	Bridges and Other Structural Systems **Course Code:** CIV ENG 4Y04
Session Offered:	Winter 2026
Calendar Description:	Bridge loads and analysis for load effects. Design of (steel beam - concrete slab) composite floor system and steel plate girders. Stresses, ultimate strength, and design of pre-stressed concrete girders. Fatigue design.
Pre-Requisites:	CIVENG 3G04, 3J04 or registration in CIVENG 4N04
Website:	Avenue to Learn (http://avenue.mcmaster.ca).
Instructor:	Dr. Cancan Yang, yangc106@mcmaster.ca, 905.525.9140 x 27054, JHE 339
Teaching Assistants:	Rishav Jaiswal (jaiswr2@mcmaster.ca) Tianyang Yin (yint16@mcmaster.ca)
Lectures:	**Time:** Mondays 2:30 pm – 4:20 pm; Wednesdays 2:30 pm – 3:20 pm **Location:** PGCLL M16
Tutorials:	**Time:** Thursdays 10:30 am - 12:20 pm **Location:** HSC 1A4
TA Office Hours:	**Time:** Thursdays 1:30 pm - 2:30 pm; **Location:** JHE 329A
Instructor Office Hours:	**Time:** Wednesdays 3:30 pm – 4:30 pm; **Location:** JHE 339
Code and Design references:	CSA S6 – Canadian Highway Bridge Design Code. Canadian Standards Association (CSA). Available at: https://library.mcmaster.ca/databases/csa-standards-csa-ondemand CSA A23.3 Concrete Design - Chapter 18 Prestressed Concrete. Canadian Standards Association (CSA). Available at: https://library.mcmaster.ca/databases/csa-standards-csa-ondemand CSA S16 Design of Steel Structures. Canadian Standards Association (CSA). Available at: https://library.mcmaster.ca/databases/csa-standards-csa-ondemand Handbook of Steel Construction, Canadian Institute of Steel Construction. CPCI Precast Concrete Design Manual. Canadian Precast Prestressed Concrete Institute.
Recommended Textbooks:	Collins, Michael P. and Mitchell, Denis., “Prestressed Concrete Structures” Prentice Hall, Inc., 1991. Nawy, Edward G., “Prestressed Concrete: A Fundamental Approach”, 5th Edition, Prentice Hall Inc., 2009. Kulak GL, Grondin GY. 2016. Limit States Design in Structural Steel. 10th Edition, 2nd Revised Printing. Canadian Institute of Steel Construction, Markham ON.

1. COURSE OBJECTIVES

This course focuses on the analysis, mechanics, as well as design principles and methods of prestressed concrete and structural steel for short to medium-span highway bridges and other structural systems. Topics addressed in this course include the loads specific to bridge structures, the response of single and continuous span bridges to these loads, analysis and design of prestressed concrete girders, steel-concrete composite girders/floor systems, and steel plate girders. Students will also apply the bridge design standards to design prestressed concrete and steel bridge components and gain an understanding of the reasoning behind key code provisions.

2. COURSE SPECIFIC POLICIES

Course Materials: Lecture-related documents (e.g., relevant code provisions, class examples) will be distributed via Avenue to Learn. These materials will be organized by teaching topics for easy reference. Students are expected to check Avenue to Learn daily to stay updated.

Assignments: Assignments must be submitted as a single electronic file to Avenue to Learn under Assessment > Assignment by the due date. Late submissions will incur penalties as follows: 1) From 0–48 hours late: 1% penalty per hour. 2) No submissions will be accepted after 48 hours.

Each assignment must include a cover page with the following information: Course title (e.g., CIV ENG 4Y04 – Bridges and Other Structural Systems), Assignment number (e.g., Assignment #3), Submission date, and Student name.

MSAF assignments will be extended for 48 hrs following their original due dates.

Exams: The date and time of the term test will be Feb 26, 10:30 am – 12:00 pm. The final exam will be 2.5 hours long and will take place during the designated final examination period. If a student misses the term test and submits an MSAF, their term test grade will be replaced by their final exam grade.

3. TENTATIVE SCHEDULE

WEEK	Topics	Assessment Tools
WEEK 1	**Introduction to Bridge Engineering** Types of bridges and materials for modern bridges; Bridge components and terminology; Introduction to CSA S6: Canadian Highway Bridge Design Code; Bridge limit states and analysis.	Assignment 1; Term test; Final exam.
WEEK 2	**Loads on Bridges and Structural Analysis** Load factors and load combinations (LRFD); Loads on bridges.	
WEEK 3	**Loads on Bridges and Structural Analysis** Structural analysis of bridges.	
WEEK 4	**Prestressed Concrete Girders** Basic concepts of prestressing and mechanical properties;	Assignment 2; Term test; Final exam
WEEK 5	**Prestressed Concrete Girders** Serviceability limit state design.	
WEEK 6	**Prestressed Concrete Girders** Serviceability limit state design; Transfer and development lengths.	
WEEK 7	Midterm Recess	No Lectures or Tutorial
WEEK 8	**Prestressed Concrete Girders** Ultimate limit state design for girders in flexure.	Assignment 3; Final exam

WEEK 9	**Prestressed Concrete Girders** Ultimate limit state design for girders in shear.	Assignment 4; Final exam
WEEK 10	**Steel Girders** Basic concepts and mechanical properties of steel-concrete composite girders;	Assignment 5; Final exam.
WEEK 11	**Steel Girders** Flexural strength of steel-concrete composite girders/floor systems; Design of shear connectors;	
WEEK 12	**Steel Girders** Basic concepts and general considerations of steel plate girders; Shear strength of steel plate girders;	Assignment 6; Final exam.
WEEK 13	**Steel Girders** Shear strength of steel plate girders; Design of transverse and bearing stiffeners.	
FINAL EXAMINATION	Scheduled during the regular University Final Examination period established by the Registrar's Office	

4. ASSESSMENT OF LEARNING	**WEIGHT %**
Assignments	20%
Term Test (Feb 26, 10:30 am – 12:00 pm)	30%
Final Exam (to be announced)	50%

Note: MASFed Term Test will be replaced with the Final Exam grade.

5. LEARNING OUTCOMES

1. Develop technical competence in determining loads, limit states and load paths for highway bridge design.
   • CEAB attribute 1.4 "Competence in specialized engineering knowledge."
2. Develop knowledge for precast/prestressed concrete and steel highway bridge components and systems.
   • CEAB attribute 1.4 "Competence in specialized engineering knowledge."
3. Develop an insight into the advantages and limitations of prestressed concrete and steel girders.
   • CEAB attribute 2.1 "Ability to identify reasonable assumptions (including identification of uncertainties and imprecise information) that could or should be made before a solution path is proposed."
4. Develop significant insight into the mechanical and structural behaviour of prestressed concrete girders, steel-concrete composite girders/floor systems,
   • CEAB attribute 2.2 "Ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem."
5. Develop an understanding of design methods for prestressed concrete and steel bridge components and the basis for code provisions.
   • CEAB attribute 2.2 "Ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem."
   • CEAB attribute 4.6 "Determines and employs applicable standards and codes of practice."
6. Get familiarized with modern tools used for analysis and design of bridge components.
   • CEAB attribute 5.2 "The ability to use of modern/state of the art tools."

6. LABORATORY SAFETY

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/.

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

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/).

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*, 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.

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 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

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