

Civil Engineering  
CIVENG 2E03  
Computer Applications in Civil  
Engineering  
*Fall 2024*



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**ENGINEERING**

## Instructor Information

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Hamid Madani  
**Email:** moafimas@mcmaster.ca  
**Office:** JHE 329A  
**Office Hours:**  
Th 9:00AM - 10:00AM

## TA Information

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**Name:** Hassan Hamed  
**Email:** hamadh6@mcmaster.ca

**Name:** Tianshuo Li  
**Email:** li2670@mcmaster.ca

**Name:** TBD

## Class Times

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**Lectures:** Th 11:30AM - 12:20PM, Fr 11:30AM - 12:20PM

**Tutorials:** Fr 12:30PM - 2:20PM (T01), We 12:30PM - 2:20PM (T02)

**Labs:** Fr 2:30PM - 3:20PM (L01), Mo 11:30AM - 12:20PM (L02)

## Class Format

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In Person

**Course Dates:** 09/03/2024 - 12/05/2024

**Units:** 3.00

**Course Delivery Mode:** In Person

**Course Description:** Numerical techniques including error analysis, root finding, linear algebraic equations, curve fitting, integration and differentiation, ordinary differential equations; sensitivity analysis; use of several software packages for numerical analysis; civil engineering applications. Two lectures, one tutorial (two hours), one lab (three hours); first term Prerequisite(s): Credit or registration in CIVENG 2P04 Antirequisite(s): ENGPYS 2CE4, CHEMENG 2E04, MECHENG 3F04, COMPENG 3SK3, ENGPYS 3NM4, MECHTRON 3X03, SFWRENG 4X03

## Instructor-Specific Course Information

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**Course materials:** Course materials will be posted on Avenue to Learn (A2L).

**Assignments:** Ten (10) regular assignments, three (3) major assignments, and nine (9) lab assignments will be assigned during the term, contributing to 60% of your grade.

**Examination:** There will be one final exam, contributing to 40% of your grade. Students may bring two double-sided crib sheets (letter size) and McMaster standard calculators.

## Important Links

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- [Mosaic](#)
- [Avenue to Learn](#)
- [Student Accessibility Services - Accommodations](#)
- [McMaster University Library](#)
- [eReserves](#)

## Course Learning Outcomes

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- Describing the basic principles of modelling mathematical problems that occur in engineering
- Understand the main tools available in numerical analysis
- Write MATLAB programs that use numerical methods to solve engineering problems
- Understand numerical techniques, including error analysis, root finding, linear algebraic equations, curve fitting, integration and differentiation, ordinary differential equations
- Apply numerical techniques to various civil engineering applications

## Graduate Attributes

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The Canadian Engineering Accreditation Board (CEAB) is a division of Engineers Canada and is responsible for accrediting undergraduate engineering programs across Canada. Accreditation by the CEAB ensures that the engineering programs meet a national standard of quality and cover essential educational requirements. Graduate Attributes are a set of qualities and skills that the CEAB expects engineering graduates to possess. These attributes are a benchmark for the learning outcomes of accredited engineering programs. This section lists the Graduate Attribute Indicators associated with the Learning Outcomes in this course.

A03 INVESTIGATION – 3.1 Selects appropriately from relevant knowledge base to plan appropriate data collection methods and analysis strategies.

A04 DESIGN - 4.1 Defines the problem by identifying relevant context, constraints, and prior approaches before exploring potential design solutions.

A05 USE OF ENGINEERING TOOLS - 5.2 Successfully uses engineering tools.

## Lab Safety

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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". It is your responsibility to understand McMaster University Workplace and Environmental Health and Safety programs and policies. For information on these programs and policies please refer to [McMaster University Health and Safety](#). The Lab Safety Handbook is available [here](#), as well as on A2L.

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment. A laboratory-specific set of rules can also be added to ensure that students fully understand laboratory safety rules that are in place prior to their first session.

## Course Schedule

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A weekly breakdown of the course schedule

Week	Topic	Assessment
1. Sep 5 & 6	<ul style="list-style-type: none"> <li>• Computing and Engineering Problem Solving</li> <li>• Programming and Software</li> </ul>	Sep 13: Assignment 1
2. Sep 12 & 13	<ul style="list-style-type: none"> <li>• Approximations and Round-Off Errors</li> <li>• Roots of Equations (Graphical and Bisection Methods)</li> </ul>	Sep 20: Assignment 2
3. Sep 19 & 20	<ul style="list-style-type: none"> <li>• Roots of Equations (The False-Position Method)</li> <li>• Truncation Errors</li> </ul>	Sep 27: Assignment 3

Week	Topic	Assessment
4. Sep 26 & 27	<ul style="list-style-type: none"> <li>• Roots of Equations (Newton-Raphson and Secant Methods)</li> <li>• Solving Systems of Equations (Graphical Method and Cramer's Rule)</li> </ul>	Oct 4: Assignment 4
5. Oct 3 & 4	<ul style="list-style-type: none"> <li>• Solving Systems of Equations (Method of Elimination)</li> <li>• LU Decomposition</li> </ul>	Oct 10: Major Assignment 1 Oct 11: Assignment 5
6. Oct 10 & 11	<ul style="list-style-type: none"> <li>• Matrix Inversion Using LU Decomposition</li> <li>• Special Matrices and Gauss-Seidel</li> </ul>	Oct 25: Assignment 6
Oct 17 & 18: Midterm Break		
7. Oct 24 & 25	<ul style="list-style-type: none"> <li>• Curve Fitting (Introduction)</li> <li>• Curve Fitting (Linear Regression and Goodness of Fit)</li> </ul>	
8. Oct 31 & Nov 1	<ul style="list-style-type: none"> <li>• Curve Fitting (Nonlinear Relationships)</li> <li>• Newtonian: Linear, Quadratic, General nth Order and Lagrangian<sup>2</sup> Interpolation</li> </ul>	Nov 1: Assignment 7 Nov 1: Major Assignment
9. Nov 7 & 8	<ul style="list-style-type: none"> <li>• Spline Interpolation</li> <li>• Integration estimation (Trapezoidal Rule)</li> </ul>	Nov 8: Assignment 8

Week	Topic	Assessment
10. Nov 14 & 15	<ul style="list-style-type: none"> <li>Integration estimation (Simpson's Rule)</li> <li>Integration estimation (Romberg)</li> </ul>	Nov 15: Assignment 9 Nov 15: Major Assignment 3
11. Nov 21 & 22	<ul style="list-style-type: none"> <li>Integration estimation (Gauss Quadrature)</li> <li>Numerical Differentiation and Richardson Extrapolation</li> </ul>	Nov 15: Major Assignment 3
12. Nov 28 & 29	<ul style="list-style-type: none"> <li>Runge-Kutta Methods I</li> </ul>	Nov 29: Assignment 10
13. Dec 5	<ul style="list-style-type: none"> <li>Course Wrap-Up</li> </ul>	
FINAL EXAMINATION: Scheduled during the regular University Final Examination period established by The Registrar's Office		

Note: This course schedule is tentative—the instructor and the University reserve the right to modify elements of the course during the term. If this happens, the class will be given reasonable notice, an explanation, and an opportunity to comment, although I will not necessarily make changes in response to comments received. It is your responsibility to stay informed of changes by attending all lectures and by checking the course website regularly.

## Required Materials and Texts

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Textbook Listing: <https://textbooks.mcmaster.ca>

### Lecture Notes

## Optional Course Materials

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Textbook Listing: <https://textbooks.mcmaster.ca>

## Numerical Methods for Engineers

ISBN: 978-1-260-23207-3

Authors: Raymond P. Canale, Steven C. Chapra

Publisher: McGraw-Hill

Publication Date: 2021

Edition: 8th

## Course Evaluation

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Assessment of Learning	Weight
Lab Assignments	20%
Regular Assignments	20%
Major Assignments	20%
Final Exam	40%
Total	100%

**Submission:** All assignments will be submitted in the designated dropboxes on the course website.

## Grading Scale

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The McMaster 12 Point 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

Grade	Equivalent Grade Point	Equivalent Percentages
D-	1	50-52
F	0	0-49

## Late Assignments

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It is the student's responsibility to regularly check A2L and McMaster email for updates and announcements. For assignments, late submission without approved extensions will result in a 10% penalty per day for the first two days then a 20% penalty per day. Late assignments that are submitted after six (6) days from the deadline will not be accepted.

## Absences, Missed Work, Illness

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MSAF Policy: When a self-reporting relief is submitted for missed work, a six-day extension will be granted. It is your responsibility to inform the instructor of your MSAF submission. When accommodations are made, they will be confirmed by email from the course instructor; if you have not received email confirmation from the instructor, you should assume that your MSAF has not been received or processed. The weight of any missed work that is properly reported and approved through MSAF will automatically be transferred to the final examination.

## APPROVED ADVISORY STATEMENTS

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### 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-proceduresguidelines/), located at <https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/>

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.

## **Courses with an On-line Element**

***Some courses may*** use on-line elements (e.g. e-mail, Avenue to Learn, 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.

### **Equity, Diversity, and Inclusion**

The Faculty of Engineering is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Faculty, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the [Equity and Inclusion Office](#).

### **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.

### **Academic Advising**

For any academic inquires please reach out to the Office of the Associate Dean (Academic) in Engineering located in JHE-Hatch 301.

Details on academic supports and contact information are available from:

<https://www.eng.mcmaster.ca/programs/academic-advising>

## **Requests for Relief for Missed Academic Term Work**

In the event of an absence for medical or other reasons, students should review and follow the [Policy on Requests for Relief for Missed Academic Term Work](#).

## **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.

## **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, Avenue to Learn and/or McMaster email.