

Engineering Physics
ENGPHYS 2NM4
Numerical Methods for Engineering
Fall 2026



ENGINEERING

Instructor Information



Michael Welland
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Office: NRB B120
Office Hours:
Fridays 10 - 12am

TA Information

Name: TBD

Class Times

Activity	Day(s)	Time	Location
Lecture	Tuesday, Wednesday, Friday	12:30 PM - 1:20 PM	JHE 264
Lab	Wednesday, Thursday	2:30 PM - 5:20 PM	KTH B124
Lab	Friday	2:30 PM - 5:20 PM	KTH 109

Class Format

In Person

In-person attendance is required for this course.

Course Dates: 09/08/2026 - 12/10/2026

Units: 4.00

Course Delivery Mode: In Person

Course Description: Applied numerical methods for engineering including solution of systems of algebraic equations; numerical integration and differentiation; finite difference and finite element methods; ODE solutions; Optimization; Partial differential equations; Monte Carlo simulation and statistical distributions. Three lectures, one lab (three hours); fall term Prerequisite(s): Registration in Level II or above of an Engineering program and credit or registration in MATH 2Z03 Antirequisite(s): ENGPYHS 2CE4, 3NM4, CHEMENG 2E04, CIVENG 2E03, COMPENG 3SK3, MECHENG 3F04, COMPSCI 3X03, 4X03, MECHTRON 3X03, SFWRENG 4X03

Instructor-Specific Course Information

Communication: A2L announcements or MSTEams Channel

Project submission and grade tracking on A2L

Important Links

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

[OER textbook - Executable Engineering](#)

[Google Colab](#)

Supporting material:

[Numerical Methods for Engineering in Python3](#)

[Python numerical methods](#)

[Holistic numerical methods](#)

[Techniques of high-performance computing](#)

[McMaster Data Analysis Support Hub \(DASH\) for Python programming](#)

Course note recordings: https://www.youtube.com/@McMaster_EngPhysNM

Course Learning Outcomes

- Application of numerical methods to real-world engineering problems.
- Hierarchical decomposition of complex problems into simpler building blocks.
- Practical grasp how numbers are stored numerically (computationally), how functions are applied, and solutions represented.
- Proficiency in the theory and application of numerical methods and their parameters.
- Use of computational tools for numerical methods, including personal implementations, software packages, and AI generated solutions.

Graduate Attributes

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.

Lab Information

Labs are held weekly by section in person (please bring your own laptop). TAs will be available to help with issues and provide advice on the current assignment and general topics.

Labs will follow a two week schedule:

- Week 1: Presentation of assignment and time to work on it, to be completed later in the week.
- Week 2: Scheduled oral examination (or written alternative).

If you are unable to attend a time slot, please notify the designated TA **to make alternative arrangements**.

Lab 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". 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.

As this is a computer-lab, please consider ergonomics during prolonged use: [Laptop ergonomics video](#)

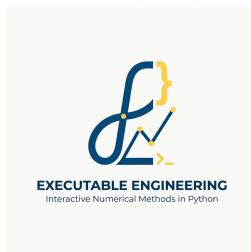
Course Schedule

A weekly breakdown of the course schedule

Week	Topic
1	Truncation and round-off error
2	Linear systems - Direct
3	Linear systems - Iterative
4	Interpolation and curve fitting
5	Roots of equations
Midterm Break	
6	Optimization
7	Numerical differentiation
8	Numerical integration
9	Differential equations: Initial value problems
10	Boundary value problems and partial differential equations
11	Finite element method
12	Eigen value problems
13	Project presentations and review

Required Materials and Texts

Please sign in with your MacID [here](#) to view your booklist



Executable Engineering: Interactive Numerical Methods in Python

Authors: M. Welland

Publisher: Available online

Open education resource

<https://themintlab.github.io/ExecutableEngineering/>

Python

Assignments will be done in Python.

The assignments will be delivered using Google Colab

(<https://colab.research.google.com/>), a free browser-based Jupyter notebook environment. It is recommended to use Colab to complete the assignments since it provides a uniform, version-controlled environment.

Access to a computer

Access to a computer is required for this course. A laptop brought to labs is ideal but public resources are possible.

Course Evaluation

Course evaluation is developed with Universal Design in Learning principles.

1. Weekly comprehension quizzes every Tuesday (5%)

These quizzes review your comprehension of the material from the past week, targeting the Spaced Repetition learning practice. To get maximum benefit, please attempt them by yourself without memory aids. Details:

- 4 multiple-choice style questions in A2L, each of which should take you ~1 minute.
- Available all day (midnight to midnight)
- Unlimited attempts - The intention is to practice and engage recall.
- The top 10 marks will be counted towards your final score.

2. Assignments 40%

Assignments are designed to mimic industrial deliverables. You can use all the resources available to you to complete them, but you must be prepared to defend your conclusions. Therefore, each assignment is two parts:

Part 1: Written submission:

- Problems will be distributed in Colab and it is recommended you complete them there to avoid issues with package versioning.
- You can use whatever you want to complete the assignment (numpy / scipy packages, AI, Internet forums, group work, etc).
- As in industry, By submitting the assignment, you assume accountability for the answer and the method you described.
- Marks will be assigned for the correct answer and method.

Part 2: Oral discussion (time scheduled during the lab):

- The TA that marked your assignment will ask you questions about your solution.

- You should be prepared to explain and defend your written submission.
- E.g.: 'why did you do this', 'what does this line do', 'how would you change it to do...!'
- An alternative written format will be available.

3. Mid-term (25%) and Final (30%) exams

Midterms and exams will examine your deep understanding of the material through a mix of multiple choice and short answer questions. They are closed-book but you are permitted a 1 page (double sided) cheat sheet.

You must achieve $\geq 50\%$ on your final exam to pass the course.

Alternative and assessments

1a. Contribution of interactive widgets

The course textbook is intended to be an open, experiential resource that incorporated demonstrative widgets from an associated python package. Students are invited to contribute widgets that explain concepts associated with the current topic. If accepted, these contributions will be considered as proof of comprehension of the weekly topic and replace the weekly comprehension quiz. The author will also be cited in the widget code and the textbook.

A maximum of 4 contributions are permitted per student.

3a. Optional research project (up to 50% of your final exam mark)

You will have the option of conducting an individual research project, intending to foster individual curiosity and exploration:

- Culminates in a 10-min presentation (or equivalent) during the last week of class.
- The topic will be mutually agreed-on between you and Prof. Welland.
- Your final exam will be the greater of:
 - 100% Your final exam mark
 - 50% your final exam mark + 50% your project mark.

- You still must achieve $\geq 50\%$ on your final exam.

Undergraduate Grading Scale

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
D-	1	50-52
F	0	0-49

Late Assignments

- 10% a day unless alternative arrangements are made **before** the deadline. Please email the designated TA to request an extension.

Absences, Missed Work, Illness

All missed assessments are counted as zero, including those with accommodations. However, following the Universal Design in Learning principles, the lowest of the quizzes and assignments are dropped (see above for details).

Generative AI: Unrestricted Use

Students are *encouraged* to use generative AI throughout this course in all facets including,

- Generation of code
- Syntax for application of common packages
- Documentation and development of testing examples
- Explanation and assistance debugging code
- Alternative explanation of core concepts
- Consultation and emotional support

The student is solely accountable for the quality of the submitted assignment, regardless of AI usage.

This course will be used as a testbed for AI-augmented learning. Students will be invited to complete regular surveys / learning journals on their usage, and share them in an in-class discussion.

APPROVED ADVISORY STATEMENTS

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](#).

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

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. Avenue to Learn, 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, 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

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.