

We recognize and acknowledge that McMaster University meets and learns on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the "[Dish With One Spoon](#)" wampum, an agreement amongst all allied Nations to peaceably share and care for the resources around the Great Lakes.

MATH 3MB3 – Introduction to Modelling 2022 Winter Term

Instructor: Dr. Irena Papst | **E-mail:** papsti@mcmaster.ca

Office: HH 412 | **Office Hours:** Thursdays 2-3 pm EST (in person, COVID-permitting, and always [on Zoom](#))

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Office Hours: Fridays 3:30 – 4:30 pm on [Zoom](#)

Overview

This course serves as an introduction to mathematical modelling, where students will learn to translate complex, real-world systems into the language of mathematics, in order to perform careful analyses and draw useful conclusions. Course content will cover deterministic models (both discrete- and continuous-time) as well as stochastic models. Students will be taught to construct mathematical models, critically assess their assumptions and results, recognize model limitations, and clearly communicate their implications for real-world applications. Students will also gain experience programming in Python, in order to simulate models using computational methods, create informative data visualizations, and conduct reproducible research.

Course Description

MATH 3MB3 - Introduction to Modelling 3 unit(s)

Introduction to computational modelling using software such as R or MATLAB. Analytical modelling using algebra and calculus. The development and analysis of models will be illustrated with examples selected from biology, medicine, chemistry, physics, economics, or other areas of natural or social sciences. This course includes a scientific communication component.

Three lectures, one lab (one hour); one term

Prerequisite(s): One of [MATH 1AA3](#), [1LT3](#), [1XX3](#), [ARTSSCI 1D06 A/B](#), [ISCI 1A24 A/B](#); and one of [MATH 1B03](#), [1ZC3](#), 1ZZ5

Antirequisite(s): MATH 2E03



Course and Learning Objectives

Upon completion of this course, the student will be able to:

1. Identify a problem in a real-world setting and formulate a related research question suited to investigation with a mathematical model.
2. Construct a useful mathematical model that addresses a research question motivated by a real-world problem.
3. Analyze and simulate a mathematical model using analytical and computational methods.
4. Interpret model results, relating them back to the real-world application.
5. Identify model assumptions and describe how they induce limitations on the model's application to the real world.
6. Clearly communicate across all of the above steps, in writing, orally, and using data visualizations where applicable.

Lectures

Section	Date and Time	Location
C01	Monday, Thursday: 3:30 PM – 4:20 PM Tuesday: 4:30 PM – 5:20 pm	JHE 264 (and simultaneously online over Zoom)

Labs

Section	Date and Time	Location
L01	Monday: 2:30 PM – 3:20 PM	JHE 233A/234
L02	Thursday: 10:30 AM – 11:20 AM	JHE 233A/234
L03	Wednesday: 2:30 PM – 3:20 PM	JHE 233A/234

Materials & Fees

Textbooks - Recommended

- A. Sayama, Hiroki. Introduction to the Modeling and Analysis of Complex Systems. Published by Open SUNY Textbooks, Milne Library, State University of New York at Geneseo, 2015. (Freely available



online: <https://milneopentextbooks.org/introduction-to-the-modeling-and-analysis-of-complex-systems/>

- B. Langtangen, Hans Petter. A Primer on Scientific Programming with Python. 5th edition, Springer Berlin Heidelberg, 2016. (Freely available in electronic format at the [McMaster Library](#))

Textbooks - Optional

- C. Turner, Peter R., et al. Applied Scientific Computing: With Python. Springer International Publishing Springer Nature, 2018. (Freely available in electronic format at the [McMaster Library](#))

Software

We will be using Python and Jupyter notebooks for the computational aspects of this course, both of which are freely available. All students have access to McMaster's Jupyter server (<https://mcmaster.syzygy.ca/>), which allows you to work in Jupyter notebooks and code in Python without setting up any software on your computer. This is the simplest option for programming in the course. You can access the Jupyter server on any computer with a sufficiently modern computer browser, including computers found in [on-campus computer labs](#). However, if you prefer to code locally in your own machine, it is recommended that you download an Integrated Development Environment on your computer such as [Anaconda Individual Edition](#).

Course Delivery

Lectures and labs will be online until 7 Feb, after which point they are scheduled to be in-person. All lectures through the entire semester will be simultaneously streamed on Zoom, with recordings posted shortly after on [Avenue to Learn](#). To follow and participate in virtual course delivery, it is expected that you have reliable access to the following:

- A computer that meets performance requirements [found here](#).
- An internet connection that is fast enough to stream video.
- Computer accessories that enable class participation, such as a microphone and speakers.

If course activities are moved to a virtual setting and the above requirements will not be met in your case, please contact uts@mcmaster.ca as soon as possible. If you use assistive technology or believe that any of our platforms may be a barrier to participating in the course, please contact [Student Accessibility Services](#) (sas@mcmaster.ca) for support.



Course Webpage

The course webpage will be hosted on [Avenue to Learn](#), and will feature important announcements, course content, and discussion boards. Students are expected to check the webpage regularly (at least weekly) for important course updates.

Assessments

The following descriptions of assessments are preliminary. The instructor reserves the right to modify any of these elements. All updates will be posted to the course website.

Homework

Homework assignments will be given regularly throughout the semester and posted on the course. You are encouraged to collaborate with other students in the course on solving assignment problems, though each student must write up their own solutions independently and note the names and MacIDs of any collaborators at the top of their submission. Copying with minor changes from solutions prepared by another person, publication, or website, with minor changes (e.g., using different symbols or a slightly different wording) and without proper attribution is plagiarism.

Final Project

The core of this course will be the Final Project, which will be completed in groups. Students will take on a modelling project from start to finish within a topic (from a list provided by the instructor): devising a research question, setting up a model to address it, analysing and simulating the model, presenting and interpreting the results, and assessing model limitations. The main submission will be a final written report, though students will be expected to submit preliminary project phases throughout the semester, and to prepare an oral presentation based on their project work at the end of the term.

An emphasis will be placed on clear scientific communication; students are encouraged to access writing support in preparing their project submissions, and can do so through the [Student Success Centre](#).

Participation

Students will get the most out of this course through active participation and reflection. There will be several self-assessment and peer review activities to encourage students to evaluate and constructively



criticize their own work, as well as the work of others. These activities will count for the participation grade.

Evaluation

The following grading scheme is preliminary. The instructor reserves the right to modify any of these elements. All updates will be posted to the course website.

Grading Category	Weight
Homework	50%
Final Project	40%
Participation	10%

In case of difficulties

Contact the instructor or teaching assistant (in person or by email) at the first sign of trouble: the instructional team is here to support you, and the sooner you reach out to us, the more likely it is that we will be able to help you.

You may also wish to talk to an Academic Advisor in your faculty, who can help you with a variety of accommodations and requests (*e.g.*, longer or repeated absences, requests for deferral of exams, course selection, adding or dropping courses, changing programs). For students in the Faculty of Science, Academic Advising can be found in the [Associate Dean's Office](#) (BSB 129).

Requests for Relief for Missed Academic Term Work

In the event of an absence for medical or other personal reasons, students should review and follow the university's [Requests for Relief for Missed Academic Term Work](#) policy. In most cases, missed work will be addressed by reweighing work submitted from the same Grading Category at the end of the term.

One of the options available to students is the **McMaster Student Absence Form (MSAF)**. The MSAF can only be used for one assessment during the term, as long as it is worth less than 25% of the course grade. In MATH 3MB3, the only assessments that fall into this category are Assignments and Participation components. **MSAF cannot be used on the final written submission of the Final Project as it is the equivalent of a final examination for this course.**

If you must miss a lecture, it is your responsibility to find out what was covered, for instance by borrowing a classmate's lecture notes and discussing any points of confusion with the instructional team in office hours.

Late Withdrawal Option

McMaster University provides a [Late Withdrawal Option](#) to students. Those who have fallen behind with assignments and/or are not prepared to write the final examination (or submit an equivalent assessment) are encouraged to make use of this option, which they can do by contacting an Academic Advisor in their Faculty/Program Office. Students may request a Late Withdrawal, without petition, no later than the last day of classes in the relevant term. **In MATH 3MB3, a student is not eligible for Late Withdrawal once the final written report of their Final Project has been submitted.**

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.

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.

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.

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.*, 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 the [McMaster Office of Academic Integrity’s](#) webpage.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all 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.

Inclusivity

The University values integrity, inclusiveness and teamwork, and strives to support the personal and collective growth of the McMaster student community. These values are foundational to ensuring campus environments – both in-person and virtual – are conducive to personal wellbeing and academic success.

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.

Online Course Behaviour Guidelines

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms. If you are concerned about your virtual classroom experiences, the Equity and Inclusion Office (EIO) is available to advise and assist students who may be experiencing any equity, accessibility, inclusion, harassment, discrimination or sexual violence concerns. You can reach the EIO at <https://equity.mcmaster.ca/contact-us>. Thank you for joining us in ensuring that our McMaster online communities are spaces where no one feels excluded and everyone is able to enjoy learning together. Students who have access to authorized recorded lectures in a course may use these recordings only for personal or group study and should not



reproduce, share or upload the recording to any publicly accessible web environment. Similarly, notes, slides, evaluations and tests are for personal use and should not be shared with others outside of a course.

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.

Disclaimer

The instructor and university reserve the right to modify elements of the course during the term. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.