



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 3F03 – ADV DIFF EQN-REVISED syllabus 2021 Fall Term

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Website: <https://ms.math.mcmaster.ca/courses/math3F03/>

Note: This is the final version of the course outline. Note that this course will NOT be listed on Avenue to Learn, but will be accessed via Microsoft Teams.

COURSE DESCRIPTION AND OBJECTIVES

In this class we will study systems of ODE's from a qualitative point of view. One can rarely find explicit solutions of nonlinear ODE's or systems, and hence we must use qualitative techniques to study them. We will mostly be interested in the long-time behavior of solutions, and the concept of stability will be central to the course. We will use methods from previous courses in ODE and linear algebra and adopt a more geometrical approach to classify the behavior of solutions.

Calendar description: Systems of ordinary differential equations, autonomous systems in the plane, phase portraits, linear systems, stability, Lyapunov's method, Poincare-Bendixson theorem, applications.

Three lectures, one tutorial; one term

Prerequisite(s): [MATH 1C03](#), [2C03](#); and [MATH 2X03](#) (or MATH 2A03 or [ISCI 2A18 A/B](#)); and credit or registration in [MATH 2R03](#)

Course Objectives:

Students will be expected to:

- to learn precise statements of definitions and theorems presented in class, their proofs, and to recognize when they apply (and when they don't!) and use them.
- to analyze equilibria of two-dimensional linear and nonlinear systems of equations to determine stability and instability.
- to use analytical and geometrical methods to determine the dynamics of linear and nonlinear systems.
- to develop critical thinking and feedback delivery skills.

Topics

Topics will include: Linear systems of differential equations, linear stability theory. Nonlinear systems: existence and uniqueness, one and two dimensional flows, phase space, limit cycles, Poincaré-Bendixson theorem, bifurcations, Hopf bifurcation.

- *This is meant as a general outline of topics which I intend to cover. The actual material may differ according to the pace of the course, and other topics may be introduced along the way.*

Lectures



All lectures will be given on-line either during the scheduled time slot:

- MoWeTh 1:30PM - 2:20PM **or** via video recordings.

While my preference is for all of the course to be presented live, technical and pedagogical issues may make this unfeasible, and some parts of the course may be given as recorded video lectures or in the form of reading assignments. You are responsible for all content, whether delivered via live video streaming, video recordings, or in written form.

Communication

Delivery of lecture material will be done using Microsoft Teams or Zoom. Important information will be communicated using the course web page (<https://ms.math.mcmaster.ca/courses/math3F03>) Tests and the Final Exam will be submitted using Crowdmark. Assignments/Activities will be evaluated through Kritik. *This course will not be listed on Avenue to Learn.*

Tutorials

As with lectures, tutorials will be delivered on-line, either during the scheduled time slots (Fr 12:30-13:20) or via video recordings.

MATERIALS & FEES

REQUIRED MATERIALS/ RESOURCES

- Nonlinear Dynamics and Chaos with Application to Physics, Biology, Chemistry and Engineering, by S. Strogatz, Westview Press (**Required**)
 - *The course will cover material mostly selected from chapters 1-8*
- The Student solution manual by Mitchal Dichter, Westview Press, is recommended
- **Kritik (Required):** Kritik is an on-line platform for submission and evaluation of assignments/activities. Each activity includes three separate phases. First, you submit your solution/material as a scan/powerpoint to your Kritik account. Then, you will be asked to anonymously evaluate a certain number (4 or 5) of other students' solutions/material. Finally, you will receive the other students' evaluations of your submission, and make an evaluation of the utility of their comments. Kritik is required and will be provided for this class. You should receive an email with an invitation to create a Kritik account for this course; if you do not receive one, please contact me via email.

VIRTUAL COURSE DELIVERY

To follow and participate in virtual classes 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, speakers and webcam when needed.

If you think that you will not be able to meet these requirements, please contact uts@mcmaster.ca as soon as you can. Please visit the [Technology Resources for Students page](#) for detailed requirements. If you use assistive technology or believe that our platforms might be a barrier to participating, please contact [Student Accessibility Services](#), sas@mcmaster.ca, for support.



****Note 1:** All course information will be posted on the course webpage
<https://ms.math.mcmaster.ca/courses/math3F03/>

You are expected to check the webpage often, at least before each lecture (if you think you will not be able to do it, talk to your instructor as soon as possible).

COURSE OVERVIEW AND ASSESSMENT

Assignments/Activities and Practice Problems

Assignments/Activities will be submitted through Kritik, as described above. There will be about 5-7 assignments/activities in total, scheduled approx. every two weeks. Additional weekly practice problems will be announced on the course webpage and you should work on them before the Tutorials to take full advantage of them. The practice problems are essential for your understanding, but will not be collected and will not count towards your homework grade. You will be responsible for their content on the test and final exam.

EVALUATION – Marking Scheme

This will be made definite before class starts

Assessment	Weight
✓ ONE Midterm Test (30%)	30%
✓ Final Examination	40%
✓ Kritik	30%

Alternative marking schemes may also be used, in which case your final grade will be given by the maximum mark obtained among all schemes considered.

Midterm Tests

There will be **ONE** midterm test held during regular class time that will be submitted through Crowdmark . The tentative date is:

October 28th

Final Exam

A 2 hrs final examination using Crowdmark will cover all course material. The date and time will be announced sometime later in the term.

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”.

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.

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.

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.

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.

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.

RESEARCH ETHICS – NA

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.

Disclaimer

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of students to check their McMaster email and course websites weekly during the term and to note any changes. Announcements will be made in class and by using the course email distribution list."

