McMaster University | SCIENCE Department of Mathematics & Statistics

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 2C03 – Introduction to Differential Equations
2021 Winter Term

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Office Hours: TBA

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Class Time and Location:

- **Lectures:** Monday, Wednesday, and Thursday 5:30pm – 6:20pm (virtual)
- **Tutorials:** **T01:** Thursday 10:30am – 11:20am
  T02: Tuesday 9:30am – 10:20am
- The content of the lectures is the content of the course. You are expected to attend all lectures. 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. You are responsible for all content, whether delivered via live video streaming, video recordings, or in written form. Delivery of lecture material and tutorials will be done using Microsoft Teams or Zoom.

Course Website

https://ms.mcmaster.ca/courses/math2C03/

- Important information will be communicated using the course web page. Tests and the Final Exam will be submitted using Crowdmark. Assignments/Activities will be evaluated through Kritik and through Webassign. *This course will not be listed on Avenue to Learn.*
- You are expected to check the webpage often, at least before each lecture.

Course Description

- First order ordinary differential equations and higher order linear ordinary differential equations including Laplace transforms and series solutions.

- ODE's are everywhere and come usually from a mathematical statement of a law of physics, chemistry, biology, ecology, economics, etc...In this class we will study many types of ODE's, the theorems that guarantee existence and uniqueness of solutions, several methods to find explicit solutions to these ODE's and how to visualize and interpret the solutions. We will do this for 1st order ODE's then move to higher order, in particular 2nd order with constant coefficients, then learn the method of series solutions for non-constant coefficients problems and that of Laplace transform for ODE's with discontinuous terms.

Prerequisite(s): One of MATH 1AA3, 1LT3, 1NN3, 1XX3, 1ZB3, ARTSSCI 1D06 A/B, ISCI 1A24 A/B; and one of MATH 1B03, 1ZC3

Antirequisite(s): ENGINEER 2Z03, MATH 2M03, 2M06, 2P04, 2Z03

Course and Learning Objectives

- To understand the basic theory of ordinary differential equations (ODE) and to develop methods for solving ODE and analyzing solutions. Some stress will be placed on the underlying ideas and theoretical framework of the subject to prepare students for more advanced courses in mathematics and statistics.

Materials & Fees

Materials/ Resources:

- **Strongly Recommended:** Differential Equations with Boundary-value problems, 9th Edition, by Zill. The course will cover material selected from chapters 1-8. If you want a hard-copy book, or a looseleaf version of the book, this will be available from the Campus Store as a bundle with WebAssign included.
- **Recommended:** Elementary Differential Equations with Boundary-Value Problems, William Trench. PDF version and a students' solution manual is also available at the same web site for free! This is a "free" version of the main material covered in Zill's book. You do not need it if you purchase Zill's book.
- **Required: Kritik.** 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/whiteboard to your Kritik account. Then, you will be asked to anonymously evaluate a certain number (about 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.

- **Strongly Recommended:** WebAssign. Students are **very strongly encouraged** to subscribe to WebAssign. WebAssign is a system for on-line assignments which provides many advantages for students, including instant feedback, extra practice problems, and hyper references to an electronic version of the Zill Textbook.
    - An access code for WebAssign will be provided with the bundled purchase of a new textbook, or its looseleaf version, at Titles. If you purchased a used textbook (or an unbundled new book elsewhere,) or if you will not purchase a textbook at all, you may purchase a WebAssign subscription at the bookstore or online from the WebAssign website. Prices may vary, so double-check each options.
    - To enroll in the classlist for WebAssign, **you will need the following *class key***

      mcmaster 9699 1336

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.

Course Overview and Assessment

Topics: ***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.***

Topics	Textbooks (related material in)
• First order equations	Chapter 1,2,4 in Trench; Chapter 1-3 in Zill
• Higher order linear equations with constant coefficients	Chapter 5,6,9 in Trench; Chapter 4-5 in Zill
• Series solutions	Chapter 7 in Trench; Chapter 6 in Zill
• Laplace transform	Chapter 8 in Trench; Chapter 7 in Zill

Evaluation:

Grade Component	Weight
2 Term Tests	38% (2x19%)
Final Examination	40%
Kritik	12%
X_{max}	10% =max{best midterm, final exam, WebAssign mark}

- For those who choose not to subscribe to WebAssign, Xmax is the best midterm mark or final exam mark. 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.

Homework and Practice Problems:

Homework assignments will consist of problems of **TWO TYPES**:

1. **Kritik assignments** will be assigned roughly once per two weeks. A problem from Kritik will be more "theoretical" in flavor and help you understand the concepts behind the study of ODE's. After the first assignment is fully completed, there will be in addition a short calibration exercise.
2. **WebAssign assignments** will be assigned roughly once per week. These are more calculational in nature and help you learn the techniques for solving specific ODE's. Students who opt out of WebAssign can solve these on paper, but they will not be submitted for marking, and no solutions will be provided.

Practice Problems:

3. Practice problems, drawn from the Trench and Zill textbooks. Do as many or few as you feel necessary for test preparation. Practice problems will not be collected or otherwise evaluated. They will be announced on the course web page. No solutions will be provided.

Tutorials:

- The tutorials are intended to provide additional examples to supplement the course material, and to provide additional opportunities for students to ask additional questions and seek help. Although **attendance in tutorials** is not mandatory, it is **strongly recommended**. The first tutorial will be on Thursday Jan 14th.

Midterm Tests and Final exam:

- There are 2 midterm tests, scheduled at the normal class time (via Crowdmark,) on the tentative dates:

  February 8th and March 22nd

  The topics covered will be announced in class and on the course web page.
- Final Exam: A 2.5hrs final examination will cover all course material. The date, time, and format will be announced sometime later in the term.

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."

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 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.

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.