MAT244H1S: Introduction to Ordinary Differential Equations

Winter 2025
University of Toronto

1. Contact information

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Teaching assistants and Office hours will be posted on Quercus.

2. Course overview

2.1. **Official course description.** First order ordinary differential equations: Direction fields, integrating factors, separable equations, homogeneous equations, exact equations, autonomous equations, modeling. Existence and uniqueness theorem. Higher order equations: Constant coefficient equations, reduction of order, Wronskian, method of undetermined coefficients, variation of parameters. Solutions by series and integrals. First order linear systems, fundamental matrices. Non-linear equations, phase plane, stability. Applications in life and physical sciences and economics.

Prerequisite: (MAT133Y1/ MAT135H1/ MAT135H5/ MATA35H3/ MATA30H3/ MATA31H3, MAT136H1/ MAT136H5/ MATA36H3/ MATA37H3)/ MAT135Y5/ MAT137Y1/ MAT137Y5/ (MAT137H5, MAT139H5)/ MAT157Y1/ MAT157Y5/ (MAT157H5, MAT159H5), MAT223H1/ MATA23H3/ MAT223H5/ MAT240H1/ MAT240H5

Corequisite: MAT235Y1/ MAT237Y1/ MAT257Y1

Exclusion: MAT242H5/ MAT244H5/ MATB44H3/ MAT212H5/ MAT258Y5/ MAT292H1/ MAT267H1

2.2. **Course topics.** We will cover the following course units in MAT244. The corresponding sections of the textbook are indicated below. Not all material from the indicated sections will be covered, and some material may be covered in an order which is different from that of the textbook. More details about the coverage for each week will be announced in advance on Quercus. An approximate schedule can be found at the end of this syllabus.

Chapter 1: Introduction
Chapter 2: First-Order Differential Equations.
Chapter 3: Second-Order Linear Differential Equations.
Chapter 4: Higher-Order Linear Differential Equations.
Chapter 5: Series Solutions of Second-Order Linear Equations (**If time permits**)
Chapter 7: Systems of First-Order Linear Equations.
Chapter 9: Nonlinear Differential Equations and Stability

For more details, refer to the lecture schedule on quercus. For each section, a short list of **learning objectives** will be provided. The purpose of these learning objectives is to serve as study guide.

2.3. **Textbook and course materials.** The textbook for the course is **Elementary Differential Equations and Boundary Value Problems by William E. Boyce, Richard C. DiPrima, Douglas B. Meade, 12th Edition**. You can purchase a physical or electronic copy from the bookstore or the publisher. (Note: There are also smaller versions (without "Boundary Value Problems") but they cost the same. Earlier versions mainly differ in functionality (in comparison with online edition) and problem set. However it does not really matter since we publish on Quercus all Home Assignments).

Available resources:

- **Elementary Differential Equations and Boundary Value Problems, Student Solutions Manual, by William E. Boyce, Richard C. DiPrima, Douglas B. Meade, 12th Edition**
- **Ordinary Differential Equations by Victor Ivrii. Lecture Notes, AMS Open Math Notes.**

2.4. **Course website and communication.** All course materials, announcements, and grades will be available on Quercus at `q.utoronto.ca`. All lectures and tutorials are scheduled to take place in person. Office hours will primarily be held in person, but, for the sake of convenience, we may offer a few online office hours at the discretion of the instructors and TAs.

The University has a policy requiring that students have a UofT email address and that you check it regularly. Please use your UofT email address when contacting any member of the MAT244 team. Furthermore, please include "MAT244" in the subject line in order to ensure that your email is not missed. Please refrain from emailing your TA; their availability is limited, and reading/responding to emails is not within their TA duties. Given the difficulty in effectively communicating mathematics over email, the MAT244 team requests that you **do not** send detailed math questions over email. Instead, please make an attempt to attend office hours.

2.5. **Lectures, tutorials, office hours.** This course will consist of **two weekly lectures** and **one weekly tutorial session**. All lectures and tutorials are scheduled to take place in person. The schedule for lectures is as follows:

Section	Schedule	Instructor(s)
LEC0101	M 11-13 & W 12-13	Obinna Kennedy Idu
LEC0201	M 15-17 & W 16-17	Argam Ohanyan
LEC5101	M 18-20 & W 18-19	Jing Zhang
LEC5102	M 18-20 & W 18-19	Maximilian Klambauer

For up-to-date information on lecture and tutorial times and rooms, please refer to the official Faculty of Arts & Science 2024/2025 Timetable. Students must attend the lectures of the section for which they are officially registered and are not permitted to attend the lectures of any other section unless approved by the course coordinator. Students are expected to check the course site for updates as the contents of this syllabus may change.

Tutorials will begin the 2nd week of class (week of January 13). Students must attend the tutorials of the section they are officially registered in, and are not permitted to attend the tutorials of any other section. During tutorials, your TA will assign problems for you to work on with your peers. These tutorials will then conclude with a short **tutorial quiz**, which will be administered by your TA and will take place toward the end of your scheduled tutorial time slot. More details on tutorial quizzes can be found below.

In addition to lectures and tutorials, there will be weekly office hours held by the MAT244 team. This is an opportunity for you to ask questions outside of lectures and tutorials. No appointment is necessary; you are welcome to drop in any time during an office hour. Office hour schedules will be posted on Quercus.

The unauthorized use of any lecture or tutorial materials provided by a MAT244 instructor or TA is covered by the Canadian Copyright Act and is prohibited. Students must obtain prior written consent to any kind of use beyond a MAT244 setting. In this course, you are permitted to download materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor.

3. Evaluation and assessments

3.1. **Marking scheme.** Your final grade for the course will be computed as follows:

- Tutorial quizzes: 15%
- Midterm: 40%
- Final exam: 45%

3.2. **Assignments.** Each week, you will assignments. Assignments are neither submitted nor graded, but quizzes will be drawn from the ones that are due (with possible modifications). You are allowed to use your course notes and the textbook when completing the class assignments. Each assignment will become available approximately one week prior to the due date.

3.3. **Tutorial quizzes.** There will be **8 tutorial quizzes** drawn from the Home Assignments (minor modifications are possible). A detailed schedule will be given on Quercus. The quizzes will be administered **in tutorials**. You are required to attend the tutorial in which you are registered; if you attend another tutorial and write a quiz, it will not be graded and you will receive a 0 for that week's quiz. The quizzes will take place during the second half of your tutorial and will consist of a short written question based on the material covered in the current tutorial and/or the previous week's lectures. During the first part of tutorial, your TA will assign problems which will be similar to the quiz problem. In some tutorials, your TA may also introduce concepts which are not introduced in lecture. You will be given the opportunity to work in small groups in order to solve the assigned tutorial problems before the quiz takes place. Although you will be working with your peers in the first part of your tutorial, **once the quiz begins you will write your quiz individually**. In order to verify your identity, you **must present your TCard to your TA upon request**.

Important note: Please ensure you write your full name **as it appears on Quercus** prior to submitting your quiz. Otherwise, your TA will be unable to assign you a grade.

Your best five quiz grades will account for 15% of your final course grade; the lowest three quiz grades will be dropped. There will be no make-up quizzes. Due to the flexibility built into the marking scheme, we do not allow temporary tutorial switches. More details about the coverage of each quiz will be announced on Quercus at least one week in advance. **You are not permitted to discuss the quiz content until all tutorial sections have finished their quiz for the week.**

3.4. **Midterm test.** There will be **one midterm test**. The test may consist of a mix of short answer and written portions. Your solutions to the short answer problems will only be graded for correctness; you do not need to show your work for short answer problems. Your solutions to the written problems **will be graded for both correctness and clarity**. For written problems, it will not be enough to simply produce a correct final answer: you will need to show how you arrived at your answer by providing a complete and clear solution. Likewise, you may still receive partial marks even if you do not arrive at a correct final answer but demonstrate an understanding of the key ideas or progress towards the correct answer. Not all questions will be of equal difficulty or be worth the same number of points. More details about the coverage of each term test will be announced on Quercus at least one week in advance.

The midterm test will be held in person on **TBA**, locations will be announced on Quercus prior to the term tests. The midterm test is **closed-book**: no resources are permitted, and you are not permitted to bring a calculator. In order to verify your identity, you **must present your TCard to your invigilator upon request**.

If you are not able to attend the midterm test and you have a legitimate reason for being unable to attend (e.g. scheduling conflicts), you may be permitted to write the term test at an earlier time on the test day. In this case, you will be asked to complete a form containing the following information:

- Your name and UofT email.
- The reason for your absence.
- Documentation containing proof that you will be unable to attend the regular sitting.

The request form will be made available before the midterm test; the form must be submitted **at least one week** prior to the main sitting. If you submit a late request, your request will not be accepted. If your request is accepted, you will be authorized to write your term test on the same day at an early sitting with schedule to be announced later. **No other make-up tests or time slots will be offered.** The number of students who can write the early sitting is limited, and early sittings will be offered on a first-come, first-served basis. Please see the next section for the missed test policy for MAT244.

3.5. **Final exam.** The final exam for the course will take place during the final exam period for April 2025 (between April 9 and April 30, inclusive). The final exam will take place in person and will be **3 hours in length**. The final exam will account for 45% of your final grade. More details will be given closer to the final exam period.

4. Course policies

4.1. **Policy information.** Please note that effective for the Fall/Winter 2023-24 session, the Absence Declaration Policy has changed and students are only permitted to submit the absence declaration once for an undocumented reason across all courses. If a student needs to submit another absence after their first undocumented one, they may need to provide some form of documentation to an instructor or for a petition. The declaration is available on ACORN under the Profile and Settings menu. Please see `https://registrar.utoronto.ca/policies-and-guidelines/absence-declaration/` and `https://www.artsci.utoronto.ca/current/academics/student-absences` for more information about absence declaration and about acceptable forms of documentation.

4.2. **Missed term test policy.** In case of a missed midterm test, you will be asked to provide documentation to support your request for academic consideration. If approved, the weighting of any missed term test will be moved to the final exam. A link to a missed test form will be made available on Quercus. You will be required to submit this form at most one week after the term test has taken place.

4.3. **Missed quiz policy.** No adjustments will be made for missed tutorial quizzes, since the lowest three quiz grades are dropped. The remaining quizzes will contribute to your overall quiz grade for the course.

4.4. **Email policy.** Should you have a question that is not answered on the syllabus or the course website (please check there first!) please note that all communications with the MAT244 team must be sent from your official utoronto email address, with the course number included in the subject line. If these instructions are not followed, your email may not be responded to. For questions related to your specific lecture section, please contact your instructor directly. For mathematical questions, we strongly prefer that you visit during office hours.

5. Institutional policies and support

5.1. **Academic integrity.** The MAT244 team is strongly committed to assigning grades based on our students' honest efforts to demonstrate learning in this course. Academic dishonesty in any form will thus not be tolerated in this course. All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters:
`https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019`.
If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to the course coordinator. Note that you are expected to seek out additional information on academic integrity from the course coordinator or from other institutional resources (for example, the University of Toronto website on Academic Integrity `http://academicintegrity.utoronto.ca`). **Potential offences** include, but are not limited to:

- Using any sort of aid (notes, textbook, the Internet, etc.) during a term test or quiz.
- Having another student write an assessment for you, or impersonating someone else in writing one of these assessments.
- Posting course materials (including quizzes, tests, announcements, etc.) online.
- Submitting questions to assessments online, or obtaining answers online.
- Communicating with another person during a quiz or test.
- Talking to others about the content of an assessment before it has finished for all sections, including posting the content online.
- Submitting an altered term test or quiz for re-grading.
- Violating term test or quiz procedures.

5.2. **Copyright.** Course materials belong to your instructors, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. Do not download, copy, or share any course or student materials without the explicit permission of the instructors.

5.3. **Accessibility.** The University provides academic accommodations for students with disabilities in accordance with the terms of the Ontario Human Rights Code. This occurs through a collaborative process that acknowledges a collective obligation to develop an accessible learning environment that both meets the needs of students and preserves the essential academic requirements of the University's courses and programs. Students with diverse learning styles and needs are welcome in this course. If you have a disability that may require accommodations, please feel free to approach your course coordinator and/or the Accessibility Services office as soon as possible. The sooner you let us know your needs the quicker

we can assist you in achieving your learning goals in this course.
Link to Accessibility Services website: https://studentlife.utoronto.ca/department/accessibility-service

5.4. **Equity, diversity and inclusion.** The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. UofT does not condone discrimination or harassment against any persons or communities.

5.5. **Important academic dates and deadlines.** The academic dates include enrolment dates, drop deadlines, final assessment periods, petition deadlines and more. https://www.artsci.utoronto.ca/current/dates-deadlines/academic-dates

5.6. **Other academic and personal supports.**

- Writing Centre: https://writing.utoronto.ca/writing-centres/arts-and-science
- UofT Libraries: https://onesearch.library.utoronto.ca
- Feeling Distressed? https://studentlife.utoronto.ca/task/support-when-you-feel-distressed
- Academic Success Centre: https://studentlife.utoronto.ca/department/academic-success
- College/Faculty Registrars: https://future.utoronto.ca/current-students/registrars

6. Schedule and important dates

Please see https://www.artsci.utoronto.ca/current/dates-deadlines/academic-dates for key dates set by the Faculty of Arts & Science, including add deadlines and holidays. Some important dates for 2024-25 to note include:

- Winter classes begin: January 6
- Winter reading week (no classes, tutorials, or office hours): February 17 - 21
- Last day to drop S courses: March 10
- Winter classes end: April 4
- Winter final exam period: April 9 - 30