This syllabus is long but contains a lot of important information, including most of the types of questions you’re likely to have throughout the semester. Not reading it, and asking the instructor a question easily located here, is bad etiquette. The above table of contents is “clickable” for easy navigation.
1 Course Website

All important information is regularly maintained on the course website

http://www.math.toronto.edu/nhoell/MAT234

Please bookmark the page for your convenience and check in regularly. You are expected to check your email regularly throughout the semester as you will receive exam and other course-related announcements sent to your inbox throughout the semester. Important announcements will be posted on the course website as well. If you ask an instructor questions whose answer is easily found in the main course page you may find your instructor staring at you quizzically. If you email your instructor asking a question whose answer is easily found on the course website, you should expect no response for what are, I hope, obvious reasons.

2 Course Calendar Description

The course calendar description for MAT234 is as follows:


We expect you to have solid working knowledge of calculus and linear algebra. Any weaknesses you may have on these topics will lead to pronounced difficulty on differential equations so please be sure you review this material before class begins.

3 Instructors

Your instructors this term are as follows:

- LEC0101: W 9:00–11:00 in GB220 & F 10:00–11:00 in GB220
  Instructor: Professor Nicholas Hoell
  Email: nicholashoell@gmail.com
  Office Hours: F 11-1 in PG107
- LEC0102: W 9:00–11:00 in GB120 & F 17:00–18:00 in GB120
  Instructor: Professor Aghil Alaee Khangha
  Email: a.alaeekhangha@utoronto.ca
  Office Hours: W 11-1 in PG205D

There is not a coordinator for this two-sectioned course. This means you should contact the instructor of the section you are enrolled in with any important course-related items (like medical notes, etc). We will be holding office hours throughout the term at a time decided in the near future. We encourage you to attend these hours and ask us questions on material you are having particular trouble with.

4 Teaching Assistants

Part of your tuition helps pay for University resources, one of the most valuable of which is time you can get one-on-one help from very knowledgable teaching assistants. I encourage you to make use of them. This semester the TAs are

- Behzad Khamidehi b.khamidehi@utoronto.ca
- Nikola Kuzmic nikola.kuzmic@mail.utoronto.ca
- Jung-Hyun Kim jhkim@mie.utoronto.ca
5 Tutorials

There are four tutorial sections for this course. These are offered on Wednesdays at 3PM, & 4:30PM in GB405 and on Fridays at 3PM, & 4:30PM in SF2202. These are your opportunity to learn directly from your TA and ask questions you may have lingering from the main lecture hours. You MUST be enrolled in a tutorial section. The tutorials are lead by

- W 3-4:30 with Nikola
- W 4:30-6 with Behzad
- F 3-4:30 with Hootan
- F 4:30-6 with Jason (Jung-Hyun)

6 Textbook

Our required text will be “Differential Equations: an Introduction to Modern Methods and Applications” by James Brannan and William Boyce, published by Wiley. We will be using the 3rd edition, ISBN:978-1-118-53177-8. Other editions are fine but problem set question numbers will only correspond to the 3rd edition. The substantive material hasn't changed across editions but there are variations, particularly with regard to problem numbers so be aware of this if you decide to use an older edition.

Textbooks on introductory differential equations vary. You may find the optional texts listed below may be more enjoyable that the required text. Explore!

6.1 Alternative (More Advanced) Texts

More mathematically inclined students may enjoy “Ordinary Differential Equations” by V.I. Arnold, published by MIT press. This is an excellent (and affordable), far more advanced, book on material appearing throughout this course. Those wishing to learn more of the theoretical underpinnings and extensions of topics in this course cannot go wrong with this book.

In the same vein as the book by Arnold is “Differential Equations, Dynamical Systems, and Linear Algebra” by Hirsch and Smale by Academic Press. Again, this is a (much) more advanced treatment but is also considered a classic.

6.2 Online Resources/Texts

I also recommend the free text by Gabriel Nagy available at

http://math.msu.edu/~gnagy/teaching/ode.pdf

7 Forum

We are maintaining an online Piazza forum for this course. This is an excellent venue for you to post math questions (anonymously if you wish) and offer help/solutions to questions asked previously by your peers. Helping explain your ideas to someone else is often a very helpful way to think through the material, so we encourage you to not be idle in using the forum – really try to answer questions rather than just observe. TAs and Instructors are lurking in the background to correct any answer that may be misleading/incorrect so that the forum should, once the dust has settled, be a source of accurate and reliable information. Our role in the forum is mostly to monitor.
8 Homework

There is no homework to be handed in in this course. We will give you suggested exercises to work on and you should work on every suggested problem but these are not collected or graded. They give excellent practice for our tests.

9 Quizzes

You will have some quizzes over the term. Quizzes are given in tutorials. For this reason, make sure that you always have your T-Card with you when you attend tutorials. The quizzes are not meant to be super-hard and serve as a check on your progress so you don’t end up far behind.

10 Grading

Grades will be based according to some quizzes throughout the term, two midterm exams and a final exam. Your final grade in the course will be determined by the following

- Quizzes: 5%
- Midterms: 25% for the highest, 20% for the lowest
- Final Exam: 50%

You are expected to bring your student identification (T-card), paper and a pen/pencil to tutorials as the quizzes will be written on paper you bring. You may only write quizzes in the tutorial section you are registered in.

Note on Exams
No electronic devices/aids will be allowed during the exams. It is the students’ responsibility to ensure that the allotted exam time is available.

11 Tests

There are two midterms during the semester. They are held in class on

1. Midterm 1: Wednesday, February 14th, 9:00–11:00AM
2. Midterm 2: Wednesday, March 28th, 9:00–11:00AM

The tests will be evaluated using Crowdmark so that you will receive a .pdf file via email of your graded test once it’s been fully marked.

11.1 Missed Tests

There are no makeup tests. A student presenting proof of a valid reason for missing a test will have their grading scheme adjusted to the following

- Quizzes: 5%; the lowest score will be dropped
- Midterm: 35% for the midterm taken
- Final Exam: 60%

In the unlikely event that there are two VALID medical excuses, this procedure will not be followed. Students in this circumstance will have their mark depend 95% on the final exam and 5% on the homework. Almost every student who has purported to be in this situation has failed the course due to a very low mark on the final exam. It is strongly advised that you write all 2 term tests. Missing both tests and only taking the final exam is a near guarantee of failing the course.
11.2 Medical Notes

In the case of a legitimate medical issue medical notes will be accepted ONLY from MDs. You must present your section Instructor with a University of Toronto Verification of Student Illness or Injury form available at http://www.illnessverification.utoronto.ca/index.php.

Some important remarks about these notes.

- These forms must be submitted to your course instructor within 3 business days of the missed test for the absence to not be penalized. Failure to submit proper, valid and timely documentation will result in a grade of 0 on your missed test.
- The form must have all required fields filled properly and legibly.
- The form must give the doctor’s OHIP number.
- The form must be original.
- The form is only considered valid if completed by a qualified medical doctor - not an acupuncturist, chiropractor, naturopath or other health care professional.
- Upon submission of the documentation review of the medical note will be done before it is accepted as valid. The review may include following up with your doctor, your college registrar, other departmental advisors.

Presenting a false medical excuse is a severe offence and will be dealt with through the Office of the Dean of the Faculty.

11.3 Athletic Absences

If you are a member of a University of Toronto sports team which has an event scheduled on the date of one of our tests and you wish to not miss your event then you must get a letter on University letterhead from your coach in order for this to count as an excused absence. The same grading policy towards excused medical absences applies in this instance. The only difference is that you must have the letter sent to us prior to the week of the midterm you plan on missing.

12 Contact

12.1 Email Etiquette

It is University policy that instructors need only reply to emails sent from University email accounts. Acceptable emails are of the form student@utoronto.ca, topstudent@math.toronto.edu, etc. We will not likely ever reply to a non-University email address (those from addresses like, say, studentwhoseemailidntgetreturn@hotmail.com or studentwhodidntreadthesyllabus@gmail.com). As well, any email sent to a MAT234 professor/TA should have the words “MAT234” somewhere in the subject line. Not doing this may result in no response from the recipient.

As for email etiquette, sending technical mathematics questions to your instructor is fine if they are very short and worded very precisely. Save longer questions for the beginning Q&A part of the following lecture, or ask during office hours, or during your tutorials. We also wish for you to use the online Piazza forum for discussing questions with each other (which we monitor).

You should not address us as “Hey”, “Yo”, or other highly informal salutation in an email. If you do you probably won’t get a reply. Keep in mind we get a high volume of emails each semester and it may take time before you hear back from us (if at all). Your chances of having your email read and being replied to, increase dramatically if you can follow the instructions above.
13 Blackboard

We do not really use Blackboard except for sending out email to the class or when entering marks on tests and quizzes. For any important course information you should look to the course web site listed at the front of this syllabus.

14 Academic Integrity (Important)

Cheating (including plagiarism) is very serious and, consequently, will be taken very seriously. Cheating can result in failure or worse. Don’t do it! I caution you, the instructors of MAT234 are extremely diligent in pushing for the maximum possible penalties for those found cheating. Collaboration on the homework problem sets is fine, in fact, we encourage it since discussing problems with your peers helps bolster your problem solving abilities. But any collusion during test situations will be thoroughly punished. This includes talking (or making other extraneous noises of any kind) during a test. We don’t tolerate any kind of chatter during tests.

One other thing. There are students for whom the statement “The test is now over, please put your pens and pencils down while we collect the tests” seems to not entirely register. We consider egregious dismissals of our requests to stop writing to be a form of academic integrity violations which we enforce with the same stringency as talking during a test. It’s not worth the risk!

15 Prerequisites

Regardless of any formal requisites students need to be comfortable with standard calculus concepts like

- The difference between an antiderivative and a definite integral
- The fundamental theorem of Calculus, in its many guises
- Partial derivatives
- Various notations for partial derivatives
- Matrix arithmetic and determinants, eigenvalues, eigenvectors, diagonalization, etc. This is a crucial part of the course that many students have trouble remembering how to do. Save yourself the headache and brush off your book on linear algebra now!

16 Learning Objectives

Having completed MAT234, each student will have demonstrated the ability to:

1. Classify and label ordinary and partial differential equations as well as their associated boundary/initial conditions.
2. Apply the major common solution techniques for linear ordinary differential equations (including systems of such equations).
3. Apply some solution techniques for common nonlinear ordinary differential equations.
4. Apply separation of variables technique for linear partial differential equations with homogeneous boundary conditions.
5. Model simple physical systems using differential equations.
6. Analyze and interpret the physical significance of solutions to differential equations.
16.1 Goals & Course Description

Congratulations for having read this far! This semester, we will cover a variety of topics within ordinary and partial differential equations and explore some of the recurring themes in the subject. Differential equations is a subject best learned through case studies and we will, by examining several well-known equations from physics, encounter general methodology for analyzing qualitative and quantitative behaviour of their solutions. Part of the course involves learning a “bag of tricks” which can be useful for attacking differential equations based on their “type”. Other parts of the course are about understanding qualitative features of solutions, regardless of whether one can quantitatively/explicitly solve the equation in question. Applications are an important part of the material and they will help to keep the more abstract material as grounded as possible. That said, this is a course in mathematics and so we will often be doing calculations or stating theorems which you may find abstract. This is unavoidable and is a huge part of understanding the subject.

17 The Menu

We will aim to keep roughly to the following schedule (dates refer to week containing the Monday falling on the given week):

- Week 1- Taxonomy of ODE & initial conditions. Direction Fields. Some solutions. Introduction to linear equations. Separable equations. See Ch 1 & 2.1
- Week 2- Integrating factors. Modelling. Some nonlinear problems. See Ch 2.2, 2.3 & 2.4
- Week 3 - Autonomous and exact equations. First order systems. Homogeneous linear systems with constant coefficients. See Ch 2.5, 2.6, 3.2, 3.3, & 6.1–6.3
- Week 4- Eigenvalues and phase portraits. See 3.3–3.5.
- Week 5 - Second order linear equations with constant coefficients. Vibrations. See Ch 4.2 –4.4.
- Week 6 - Undetermined coefficients. Mechanical and Electrical vibrations. See Ch 4.4–4.6.
- Week 7- Series solutions. Bessel and Legendre equations.
- Week 8- Orthogonal functions and boundary value problems. See Ch 10.1–10.3.
- Week 9 - Fourier series. Intro to partial differential equations. See Ch 10.1–10.3 and 11.1 (online).
- Week 10 -The heat equation. Laplace’s equation. See Ch 11.2 & 11.6 (online)
- Week 11 - The wave equation. See Ch 11.4 (online)
- Week 12 - Laplace Transform (time permitting). See Ch 5.1-5.7.