Math-325: Honours Ordinary Differential Equations, Winter 2023

Course Outline

- **Lectures**:
  Mon, Wed, Fri, 11:30am to 12:30pm in Arts-W120 starting Wednesday 4th January.
  The classroom is equipped with a document camera, but no blackboards. I will post a scan of my class notes after each lecture. The wearing of masks is encouraged in class.

- **Instructor Office Hours**:
  Prof Humphries, E-mail: tony.humphries@mcgill.ca
  Office Hours: Mon 1.30-2.30pm, Weds 3-4pm and Fri 3.30-4.30pm in BURN-1112.
  These office hours are shared with my other course (Math-263 ODEs for Engineers). With so many students passing through my office, I would appreciate it if those attending would mask up. Thank you.

- **Graduate Teaching Assistant**
  Matthieu Cadiot, E-mail: matthieu.cadiot@mcgill.ca
  Office Hours: Tues 2-3pm in BURN-930

- **Tutorial**
  There will be an optional 1 hour weekly tutorial, starting no earlier than Weds 11th January. One tutorial session is tentatively scheduled as
  - Wednesdays 1.35pm to 2.25pm in BURN-1214.

  We intend to hold a poll the first week of the semester, to determine need and scheduling for a second tutorial. If there are two tutorials each week, the TA will cover the same material in both sessions, so you should only attend one.

- **Syllabus**
  First and second order equations, linear equations, series solutions, Frobenius method, introduction to numerical methods and to linear systems, Laplace transforms, applications.

- **Contents**
  The intended contents are:
  - Introduction: Basic, terminology, classification.
  - First Order Equations: Integrating Factors, separable equations, linear and nonlinear equations, exact equations, existence and uniqueness.
  - Second and Higher Order Linear equations: Constant Coefficient homogeneous equations, roots of the characteristic equation, Wronskians, fundamental and general solutions. Cauchy-Euler Equations. Nonhomogeneous equations, undetermined coefficients, variation of constants (parameters), reduction of order.
  - Series Solutions: Regular Points, Regular Singular Points and Frobenius method.
  - The Laplace Transform: Definitions and properties, solving initial value problems, Discontinuities and Impulses, Convolutions.
  - Linear Systems of ODEs: Solutions and stability.
  - Introduction to numerical methods and nonlinear differential equations.

  but are subject to modification during the semester. Applications will be highlighted through examples of differential equations throughout the course.

- **References:**
  There is no required textbook. Recommended texts include
  - *Elementary Differential Equations*, 10^{th} edition, by W.E. Boyce and R.C. DiPrima.
  - *Elementary Differential Equations*, 6^{th} edition, by C.H. Edwards and D.E. Penny.
  - *Differential Equations and Boundary Value Problems*, 8^{th} edition, by D.G Zill and W.S Wright.
  - *Elementary Differential Equations*, by W.F. Trench. The pdf of this book is available online for free and legal download.

  Previous editions should be just as good. All these books come in two versions, with the more expensive one having an extra chapter on boundary value problems, which are not in the syllabus of this course. However, all of the

textbooks mentioned above cover the material at a depth suitable for the majors course MATH-315. If you are struggling in the course, then any one of these books could be really valuable to help you master the basic concepts and techniques. I will give my own treatment of the material, and will be supplying latexed notes, one chapter at a time. These notes are still under development, and may have some errors, gaps and admissions, so they are not a substitute for coming to class.

- **Prerequisites/Restrictions:** The course is intended for students in Honours Mathematics, Physics and Engineering programs. It is not open to students who have taken MATH 263 (Engineers version of this course) or MATH 315 (Majors version of this course). The only explicit prerequisite is Math 222 or equivalent. However, it is an Honours course that will be taught at an honours level and will assume a corresponding level of mathematical sophistication. In general I recommend that you only take this course if you are registered or considering registering in an honours program or have the standing to do so.

- **Webwork:** Webwork assignments will optional, and will *not* be for credit. I recommend you use them for further practice on the topics when and where you need it.

- **Assignments:** There will be regular written assessed assignments (about 6 in the semester) . Model solutions will be supplied after the hand-in deadline.

- **Midterm:** There will be a midterm exam, which is tentatively scheduled for 6.00-7.30pm on Thursday 23rd February (time and location subject to room availability).

- **Final Exam:** There will be an in person formal 3 hour final exam scheduled during the final exam period.

- **Assessment:** [Final exam 60%, midterm 20%, assignments 20%] or [Final exam 80%, assignments 20%].

- **Policies:**
  - Do not come to class if you are ill. Students who self-report covid-19 symptoms are not obligated to provide a medical note to receive appropriate academic accommodation. Contact the instructor by email as soon as you can.
  - I do not accept late homework, because I post model solutions. I generally post assignments 10 days before they are due, so do it early if you have other commitments on the due date. Also I do not give make up tests, because I do not have the resources to set or administer them.
  - That said I can and do grant academic accommodations, these should be requested from the instructor only, and in general these requests should be made *in advance*.
  - Important announcements (including posting of assignments and due dates) will be made to registered students by e-mail (via MyCourses) and/or posted on **MyCourses**.
  - I attempt to reply to e-mail in a timely fashion, but do not expect immediate responses. I usually will not reply to email sent the day before a test.

- **Copyright**
  Instructor generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.

- **Academic Integrity**
  The work you hand in should be your own effort; any collaboration must be acknowledged.

  McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr/honest/ for more information).

- **Language**
  In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

- **Learning and Wellness Resources**
  The Department of Mathematics and Statistics, as well as the University at large, have many resources to help you

succeed in this course and throughout your degree. An extensive list of resources can be found in the MyCourses Webpage for this Course (under “Content”), as well as the Department's EOSW webpage. These include

- The Math Help Desk is staffed by knowledgeable math students who can help answer your questions related to your courses. They have tutors on M-F from noon-5 PM in Burnside 911.
- The Wellness Hub is a centralized website for student physical and mental health resources.

But do check out MyCourses for the full list.

- **Extraordinary Circumstances**
  In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.
