MATH 37a: Differential Equations  
Summer 2022

Instructor: Simon T. Huynh  
e-mail address: sthuynh@brandeis.edu  
Modality: in-person  
Class-time: M, T, W, Th 4-6 PM ET  
Location: Goldsmith 317

“Any equation that contains derivatives is called a Differential Equation. The universe is described by differential equations, and solving them is Job #1 in Science.” – Larry Gonick

Learning Goals:

1. Learning key concepts including existence and uniqueness, equilibria, and bifurcations;  
2. Study differential equations using both quantitative (analytic) and qualitative (geometrical/graphical) approaches;  
3. Implement numerical approximations to solve linear and simple nonlinear equations; and  
4. Develop and leverage a learning community for math.

Prerequisite: MATH 15a or 22a and MATH 20a or 22b.  
Students should have familiarity with single-variable calculus, multivariable calculus, and linear algebra.

Course Text:

• (Required) The Ordinary Differential Equations Project, Thomas W. Judson;  
  http://faculty.sfasu.edu/judsontw/ode/html-snapshot/odeproject.html  
The required text is open source and freely available online at the link above.


Other Resources and Equipment:

• Technology: Students will need a computer/laptop/smartphone with internet service to access and submit online assignments. You should also have MATLAB and Mathematica installed on your computer (both are freely available to Brandeis students). Students with financial need should contact Student Financial Services or Academic Services to discuss options available to purchase equipment and other technology or supply needs.

• Working in Groups: Study groups of 2 or 3 students will be formed. Studying together makes it more enjoyable, and helps you learn difficult material. Even if you think you know everything, explaining concepts to someone else helps you master the material.

• Expectation: Success in this accelerated summer 4-credit class is based on the expectation that students will spend a minimum of 27 hours of study time per week (outside of class time).

LATTE:
All course materials will be available online on LATTE. Log in at http://latte.brandeis.edu using your Unet username and password.
Course Work and Grading:

- **Participation: 15% of total grade**
  - To earn points for participation, students are expected to complete Perusall reading assignments and actively engage in in-class group activities.
  - Online reading and in-class group assignments will be graded based on completion.

- **Homework Assignments: 25% of total grade**
  - Each weekly homework assignment will be graded out of 50 points. Students can earn up to 30 completion points for attempting all the assigned problems and we will grade 10 items, each worth 2 points, using the following criteria:
    * (2 pts/2) The graded item is completely solved and sufficient work is shown. The work is clear and legible. The submission may contain some minor (numerical) mistakes.
    * (1 pt/2) The item is partially solved or incomplete. The work is clear and legible. The key idea is missing or there is a major mistake in the submission.
    * (0 pt/2) There is no evident of attempting the question. The work is messy/not legible.

- **Midterm and Final Assessments: 60% of total grade**
  - There will be two assessments, each is worth 30% of the total grade.
    - The **midterm** will be on Tuesday, June 21th and the **final** assessment will be on Tuesday, July 5th.
  - Each question on the exam will be graded on a 4-point scale:
    * (4 pts/4) The answer exceeds the expectation. Full Scores.
    * (3 pts/4) The work meets the expectation. Student demonstrates a full understanding of the problem even though there may be some minor errors or small imperfections.
    * (2 pts/4) The work does not quite meet the expectation but the student demonstrates a partial understanding of the problem.
    * (1 pt/4) The work is below the expectation. The student attempts the problem but demonstrates little or no understanding.
    * (0 pt/4) No submission. No evidence of attempting the question.
  - No partial credit will be given.
  - After the exam is graded, students will have an option to submit rewrites of any incorrect answers (2 points or less on the grading scale above) and can earn a new score up to a maximum of 3 points on each incorrect answer by providing the correct response.

If you have further questions about how this course is graded, please do not hesitate to reach out to me!
Other Course Information

Late Work: We understand that life sometimes gets in the way of our studies, or prevents us from completing an assignment or attending class. If you aren’t able to complete an assignment on time, please communicate with me as soon as possible. We’ll work together to make sure you don’t fall too far behind. Note: The summer session is really fast paced. One day worth of our materials is equivalent to one week worth of materials in a 15-week course.

Expectation: Success in this accelerated summer 4-credit class is based on the expectation that students will spend a minimum of 27 hours of study time per week in preparation for class (readings, completing homework assignments, studying and reviewing for the midterms, etc.)

Accommodations:
Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, please talk with me and present your letter of accommodation as soon as you can. I want to support you in any ways I can.
In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documentating a disability or requesting accommodations, please contact Student Accessibility Support (SAS) at 781.736.3470 or access@brandeis.edu

Academic Integrity:
You are expected to follow the University’s policy on academic integrity, which is distributed annually as section 4 of the Rights and Responsibilities Handbook (see http://www.brandeis.edu/studentaffairs/srcs/rr/index.html). Instances of alleged dishonesty will be forwarded to the Department of Student Development and Conduct for possible referral to the Student Judicial System. Potential sanctions include failure in the course and suspension from the University. If you have any questions about how these policies apply to your conduct in this course, please ask.

Available Resources:
Many resources are available to help with the academic and non-academic factors that contribute to student success (finances, health, food supply, housing, mental health counseling, academic advising, physical and social activities, etc.). Please explore the links on the Support at Brandeis page https://www.brandeis.edu/support/undergraduate-students/browse.html to find out more about the resources that the University provides to help you and your classmates achieve success.

Timely communication:
Use your Brandeis email to reach out to me. I am usually able to respond quickly to most messages, within 24 hours, although during the weekends and over holidays it could take me longer. If I reach out to you, with a query or comment or in response to an email from you, I would appreciate it if you would acknowledge receipt of my message and/or respond with 24 hours, unless it is during weekend or over a holiday. Note that we will use your Brandeis email address, so you need to check it regularly.

All course announcements can be found in the Course News & Announcements page on Latte.

Name/Pronouns:
If you have a preferred name and/or preferred pronouns you would like me to use, please let me know either by email or in class. Thanks!
Topics:
We will cover the following sections from our textbook this semester:

Note: Some topics may be added or omitted as time permits.

- Chapter 1: First-Order Differential Equations
  (a) General techniques
  (b) Existence and uniqueness of solutions
  (c) First-order linear equations
  (d) Equilibria and bifurcations

- Chapter 2 and 3: Systems of Differential Equations
  (a) The geometry of systems
  (b) Linear and planar systems
  (c) Solving linear systems analytically via eigenvalue decomposition
  (d) The trace-determinant plane

- Chapter 4: Second-and-Higher-Order Linear Equations
  (a) Homogeneous second-order linear equations
  (b) Harmonic oscillators
  (c) Forcing and resonance

- Chapter 5: Nonlinear Systems
  (a) Linearization
  (b) Hamiltonian systems
  (c) The Hopf bifurcation

- Chapter 6: The Laplace Transform
  (a) Discontinuous functions
  (b) Convolutions

About Me: Simon Huynh
(Pronunciation: SY-men H~WIN)

I am an Applied Math Ph.D. student interested in scientific computing, numerical simulations of physical systems, delay differential equations, and problems in science and engineering.

In my free time, I enjoy making/building things and being creative. I also love paddleboarding in the summer and snowboarding in the winter.

You can find out more about me on my personal webpage. https://people.brandeis.edu/~sthuynh95/

Pronouns: he/him/his

End of The Course Syllabus.