APMA 0330: Methods of Applied Mathematics (Fall 2018)

MWF 12:00-12:50pm, Barus & Holley 168

Instructor: Sona Akopian

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- Canvas: https://canvas.brown.edu/courses/1076676
- Office Hours: Mon/Tues 11am-12pm at 170 Hope St. room 108, or by appointment

Teaching Assistants:

Justin Dong (justin_dong@brown.edu)
Office Hours: Tuesdays 6-8pm at 170 Hope St., room 217

Cameron Both (cameron_both@brown.edu)
Office Hours: Fridays 3-5pm at 182 George St., room 110

Ellen Li (ellen_li@brown.edu)
Office Hours: Mondays 5-7pm at 170 Hope St., room 108

Textbook:

Elementary Differential Equations and Boundary Value Problems [7th edition]
by W.E. Boyce and R.C. DiPrima, published by John Wiley & Sons Inc. I will provide a PDF version of the book so you do not need to buy it.

Prerequisites:

MATH 0100, 0170, 0180, 0190, 0200, 0350, minimum score of 4 in 'AP Calculus BC', minimum score of 5 in 'AP Calculus BC' or minimum score of WAIVE in 'Graduate Student PreReq.'

Goals:

This course will cover mathematical techniques involving ordinary differential equations used in the analysis of physical, biological, and economic phenomena. The course emphasizes established methods and their applications rather than rigorous foundation. Topics include: first and second order differential equations, an introduction to numerical methods, series solutions, and Laplace transformations.

Lectures:

In the lectures, you will see the material firsthand and will be able to listen to and participate in discussions about it; we will have small-group discussions during class that enable you to spot any conceptual difficulties quickly. Attendance is strongly recommended.

Recitation Sessions:

During recitations, you will work in groups to solve the more challenging problems on the homework sets with some guidance of the TAs. You will also have the opportunity to ask your TAs to clarify anything you didn't understand in lecture. Participation in recitation sessions is not required but is strongly recommended.

Recitation Schedule		
Tuesdays/Thursdays	5-6pm	Barus & Holley 165

Homework:

Homework will be assigned on Wednesdays and due one week after they were assigned, by 12pm in the homework drop-off cabinets in the lobby of 182 George Street. The graded assignments should be ready for pick-up within one week and can be picked up from the pick-up bins next to the drop-off cabinets. You may, and are encouraged to, collaborate on homework with other students; however, assignments must be written up separately and individually. Late homework assignments will not be accepted, as they cause considerable inconvenience for the TAs. No credit will be given for late work unless you have a legitimate excuse (illness/emergency), together with verification. For questions regarding homework grading or extensions, please address the TAs as they will be picking up and grading the assignments.

Assignments will be structured as follows: the first part will be fairly straight-forward exercises from the textbook which will be graded for completion only. Answers to these exercises can be found in the back of the book, so for the most part we will not provide solutions to those problems. The second part of the homework will consist of 3-4 more challenging problems, for which you may want the guidance of a TA during recitations. Two of these problems will be graded at random, and solutions will be posted on canvas usually within a week after they are due.

Assessment:

The grading scale is subject to adjustment, especially in borderline cases; adjustments may take into account class participation and improvements in performance over the semester. Minimum percentages for grade cut-offs will be approximately as (and no higher than) in the tentative scale below.

Graded work	Weight
Homework	20%
Midterm exam 1	20%
Midterm exam 2	20%
Final examination	40%

Provisional grading scale	
Grade	Percentages to aim
A	90-100%
B	80-89%
C	70-79%

Curving: I give grades based on merit and not based on how each student performs in comparison to the others. Therefore, I do not curve. However, since the final exam will be cumulative, if it will help your grade, I will replace your lowest midterm score with your score on the corresponding section of the final only (not the entire final). So if you fail a midterm, you still have a chance to redeem yourself on the final.

Midterm exams will not be given for individuals at times other than the scheduled slots, except in cases of illness, emergency or some other crisis; documentation verifying the excuse will be required, such as a note from your doctor. You need to contact me as soon as you can, before the midterm exam whenever possible, if a serious conflict arises. For final exam excuses, you must see a Dean in the Dean of the College's office.

Accommodations for students with disabilities:

If you need accommodations for classes, assignments or exams, please contact me as soon as possible. Please also contact the Student and Employee Accessibility Services (by phone 401-863-9588 or online at http://brown.edu/Student_Services/Office_of_Student_Life/seas/index.html.

Course Content	
Introduction	Definition of a differential equation, examples, classification, direction fields
First order equations	Numerical approximations - Euler's method
	First order linear equations
	Existence and uniqueness theorem
	Exact equations
	Separable equations
	Autonomous equations and qualitative analyses
	Applications: population growth, bathtub model, mixing, etc.
Linear systems of first order equations	Review of linear algebra
	Basic theory of systems of first order linear ODEs - real distinct eigenvalues
Midterm 1	***Wednesday, October 10, in class***
	Homogeneous linear systems with constant coefficients
	Nonhomogeneous linear systems
Second order equations	Homogeneous equations with constant coefficients
	Fundamental solutions and the Wronskian
	Nonhomogeneous linear equations
	Mechanical and electrical vibrations
	Higher order equations
Midterm 2	***Wednesday, November 14, in class***
Series solutions of second order equations	Review of power series
	Series solutions near an ordinary point
	Euler equations
Laplace transforms	Definition of the Laplace transform
	Solving initial value problems
Final exam	***Thursday, December 13, 9am-12pm***