Math 0290: Differential Equations, Fall 2017 (2181)
Departmental Syllabus - Trofimov section - MWF 2:00PM, 704 Thackeray Hall

Overview: Differential equations represent an important branch of mathematics. Many of their properties have been understood mathematically and they have a history of being successfully applied to important problems in all areas of science and engineering. This course will introduce primarily linear, first-order, and second-order differential equations. Solution techniques for separable equations and homogeneous and inhomogeneous equations as well as a range of modeling-based applications arising in the context of engineering, physics and chemistry will be presented. The application of Laplace transforms to differential equations, systems of linear differential equations, linearization of nonlinear systems, and phase plane methods will be covered. Fourier series, a useful tool in signal processing, will also be introduced, and we will discuss how the Fourier series arises in solving the famous heat equation by separation of variables. The idea of approximating and visualizing solutions using a computer, such as with Matlab, will be introduced early in the term and students are expected to use Matlab as a resource in their work for this course.

Textbooks: Polking, Boggess and Arnold, *Differential Equations with Boundary Value Problems*, second edition, Pearson Prentice-Hall.

Instructor information: Evgeni (Eugene) Trofimov, Thackeray 619, evt3@pitt.edu
Office Hour: MWF 3:00 - 3:45 PM or by appointment.

Grades:
Homework 20%, Two midterm exams 40% (20% each), Final exam 40%.

Assessments: (1) Weekly homework assignments will be collect at the beginning of the lecture. (2) There will be two in-class Midterm Exams. The second midterm will not be cumulative to the first. (3) **The cumulative Final Exam will take place** *at a time to be determined by the University.*

Grading scale: A/A±:90-100%, B/B±: 80-89%, C/C±: 70-79%, D/D±: 60−69%, F:<60%.

Matlab: Computers are often used to study solutions to differential equations in physics, biology, chemistry, and engineering. Right from the outset, we will discuss how Matlab can help us to visualize the behavior of solutions of differential equations and to approximate these solutions and we will give an introduction to numerical solution techniques. Matlab will not be available on quizzes/exams, however, and will not factor heavily into statements of homework problems; mostly, it is a tool that can help you understand the material better and check your solutions.

Homework policies: Students are required to complete the homework problems; very few students can learn this material without constant practice. Students are welcome to work together on homework. However, each student must turn in his or her own assignments, and no copying from another student's work is permitted. Deadline extensions for homework will not be given. Please feel free to come ask me questions about homework and other course material during office hours or to contact me to schedule alternative appointments. **Your questions are always welcome**.

Midterm exams: These assessments are to be completed in class at the assigned times. The only exception to this policy is as follows: if you have a legitimate medical or academic conflict that will prevent you from being in class for a midterm, then contact me well ahead of time to discuss alternative arrangements.

Final Exam policy: All students must take the departmental Final Exam at the time and place scheduled by the registrar.

Final Grade policy: Your final grade will not exceed your Final Exam grade by more than one letter grade.

Academic Integrity: The University of Pittsburgh Academic Integrity Code is available at http://www.provost.pitt.edu/info/acguidelinespdf.pdf. The code states that "A student has an obligation to exhibit honesty and to respect the ethical standards of the academy in carrying out his or her academic assignments." The website lists examples of actions that violate this code. Students are expected to adhere to the Academic Integrity Code, and violations of the code will be dealt with seriously.

Disability Resource Services: If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 140 William Pitt Union, 412-648-7890 as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Schedule and practice problems: The following is an approximate schedule for lectures and a full list of practice problems from the course textbook.

Week 1:
Introduction to differential equations, numerical methods and computer tools including Matlab for DEs
1.1 Number 1-11.
2.1 Number 3-6, 10-15, 21-28.
6.1 Number 1-9, 11.

Week 2:
Numerics (cont.), separation of variables.
6.2 Number 1-9.
6.3 Number 1-6, 11-13.
2.2 Number 1-22, 23-29, 33-35.

Week 3:
Modeling, linear first-order equations.
2.3 Number 1-10.
2.4 Number 1-21, 29.
2.5 Number 1-7, 9-10.

Week 4:
Modeling (cont.), second order equations.
3.4 Number 1-19.
4.1 Number 1-20, 26-30.
4.3 Number 1-36.

Week 5:
Second order equations (cont.), harmonic motion.
4.3 (cont.) Number 1-36.
4.4 Number 1-12, 14-16, 18.
4.5 Number 1-29.

Week 6:
Inhomogeneous second order equations.
4.5 (cont.) Number 1-29.
4.6 Number 1-10.
4.7 Number 3-11.

Week 7:
Midterm 1, *Laplace Transform.*
5.1 Number 1-29.

Week 8:
Laplace Transform (cont.)
5.2 Number 1-41.
5.3 Number 1-36.
5.4 Number 1-26.

Week 9:
Laplace Transform (cont.)
5.5 Number 1-25.
5.6 Number 1-9.
5.7 Number 4-24.

Week 10:
Systems of differential equations.
8.1 Number 1-16.
8.2 Number 1-6, 13-16.
8.3 Number 1-6.

Week 11:
Constant coefficient homogeneous 2×2 systems
9.1 Number 1-8, 16-23.
9.2 Number 1-27, 58-61.
9.3 Number 20-23.
9.4 Number 1-12.

Week 12:
Midterm 2, *nonlinear systems.*
10.1 Number 1-16.

Weeks 13-14:
Fourier series
12.1 Number 1-22.
12.3 Number 1-32.
12.4 Number 1-11.

Week 15:
Separation of variables for the heat equation.
13.2 Number 1-18.