Math 0290: Differential Equations, Fall 2020
Departmental Syllabus
- Trenchea section - MoWeFr 1:15-2:05 PM,
Location: 630 William Pitt Union
or virtually via Zoom (meeting ID info by email/Canvas Announcement)

Overview: Differential equations (DE) 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.

Course Delivery: The University has adopted the Flex@Pitt teaching model for this semester, and instruction will vary in form depending on the University's current operational posture. The bullet points below outline how this strategy will typically be implemented in this course, but your instructor may choose to tailor the plan to fit your section, so consult your instructor's specific directions on Canvas.

- In the Elevated Risk and High Risk postures, all instruction will be conducted remotely, and there will be no in-person class meetings. Typically this means your instructor will hold virtual class meetings through Zoom at the scheduled class time, and the links to join these synchronous meetings will be posted in Canvas. The class meetings will be recorded, uploaded to Panopto, and made available for viewing through Canvas.
- In the Guarded Risk posture, students will have the option to participate remotely or attend in-person class meetings in their section's assigned classroom at the scheduled class time. However, some sections may not have been assigned a classroom and will only be forced to meet remotely instead. Other sections may be assigned a classroom whose capacity with social distancing will permit only a portion of the students to attend on any given day. In that case, your instructor will divide the class into student cohorts, and each cohort will be assigned days that it is permitted to attend the class in person. No student will be required to attend the in-person meetings. Your instructor may choose to teach in-person, in which case the classroom will be recorded and connected to Zoom so that students participating remotely will be able to join the class meeting synchronously or watch the recorded session at a later time. Your instructor may also choose to teach remotely, in which case they will be connected to the classroom through Zoom, and students will be able to attend the class in-person (on their cohort's assigned days) or remotely. Your instructor will communicate the details of their plan through Canvas.

During the week of August 19, 2020, all instruction will be conducted remotely, regardless of the University's operational posture.

Textbooks: Polking, Boggess and Arnold, *Differential Equations with Boundary Value Problems*, second edition, Pearson Prentice-Hall.
There is a link in Canvas which includes the purchase of the electronic version of the textbook onto your tuition statement if you do not 'opt out'. This purchase offers more than what is necessary. The only requirement to this course is the textbook. Students may choose to use the first edition of the text or a used second edition, which may be available at a lower cost. If you wish to do that, you should choose the 'opt out' option prior to the add/drop deadline and visit http://calculus.math.pitt.edu and click the Textbook information link.

Instructor information: Catalin Trenchea, Thackeray 606, trenchea@pitt.edu, http://www.pitt.edu/~trenchea/
Office Hours: Tue. 2:00pm-3:30pm, Th. 9:30am-11:00am, or by appointment; (also via **zoom**).
web: http://www.pitt.edu/~trenchea/Math0290_Fall_Semester_2020.html.
The **Canvas** page for this course will contain assignments, handouts, due dates, and announcements.
Tutoring: The Mathematics Department offers a free tutoring service. The Math Assistance Center (MAC) is located on the second floor of the O'Hara Student Center. Tutoring services and tutoring hours will be posted outside the MAC as well as on the web at MAC.

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 every Monday. (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***.**
Your course grade will not exceed your Final Exam grade by more than one letter grade.

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.
Since many assessments will be administered online, proctoring might be done via ZOOM and a video connection will be required.

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

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 (DRS), 140 William Pitt Union, 412-648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Academic Integrity: The University of Pittsburgh Academic Integrity Code is available at "Academic Integrity: Avoiding Plagiarism and Understanding Research Ethics: Avoiding Plagiarism". 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.
This is especially notable during this Flex period. Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity will incur a minimum sanction of a zero score for the quiz, exam or paper in question. Additional sanctions may be imposed, depending on the severity of the infraction. Please note, in particular, that Pitt has a data sharing arrangement with Chegg.com that enables us to identify instances in which Chegg.com has been used to cheat on assessments. Consequences of being caught in this academic integrity violation have included zero scores on assessments and F grades for the course.

Health and Safety: In the midst of this pandemic, it is extremely important that you abide by public health regulations and University of Pittsburgh health standards and guidelines. While in class, at a minimum this means that you must wear a face covering and comply with physical distancing requirements; other requirements may be added by the University during the semester. These rules have been developed to protect the health and safety of all community members. Failure to comply with these requirements will result in you not being permitted to attend class in person and could result in a Student Conduct violation. For the most up-to-date information and guidance, please visit coronavirus.pitt.edu and check your Pitt email for updates before each class.

Diversity and Inclusion: The University of Pittsburgh does not tolerate any form of discrimination, harassment,

or retaliation based on disability, race, color, religion, national origin, ancestry, genetic information, marital status, familial status, sex, age, sexual orientation, veteran status or gender identity or other factors as stated in the University's Title IX policy. The University is committed to taking prompt action to end a hostile environment that interferes with the University's mission. For more information about policies, procedures, and practices, see: https://www.diversity.pitt.edu/civil-rights-title-ix-compliance/policies-procedures-and-practices.

Classroom Recording: To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities not already recorded by the instructor, without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use. Lectures will be recorded by the instructor, and this may include student participation. Students are not required to participate in the recorded conversation. The recorded lecture may be used by the faculty member and the registered students only for internal class purposes and only during the term in which the course is being offered.
Recorded lectures will be uploaded and shared with students through Canvas.

Copyright: Some of the materials in this course may be protected by copyright. United States copyright law, 17 USC section 101, et seq., in addition to University policy and procedures, prohibit unauthorized duplication or retransmission of course materials. See the Library of Congress Copyright Office and the University Copyright Policy.

Math 0290: Differential Equations, Fall 2020
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
1.1 Number 1-11. **HW: 1,2,5,7,11**
2.1 Number 3-6, 10-15, 21-28. **HW: 1,3,5,12,13,15**

Week 2:
Numerical methods and computer tools including Matlab for DEs
6.1 Number 1-9, 11. **HW: 3,5**
6.2 Number 1-9. **HW: 23**
6.3 Number 1-6, 11-13.

Week 3:
Modeling, linear first-order equations.
2.2 Number 1-22, 23-29, 33-35. **HW: 3,5,9,33**
2.3 Number 1-10. 3,5,9,33 **HW: 9**
2.4 Number 1-21, 29. **HW: 5,15,19**

Week 4:
Modeling (cont.), second order equations.
2.5 Number 1-7, 9-10. **HW: 5, 9b**
3.4 Number 1-19. **HW: 1,3,5,7,11**
4.1 Number 1-20, 26-30. **HW: 1,3,9,17**

Week 5:
Second order equations (cont.), harmonic motion.
4.3 Number 1-36. **HW: 1, 9**
4.3 (cont.) Number 1-36. **HW: 17, 35**
4.4 Number 1-12, 14-16, 18. **HW: 1, 7**

Week 6:
Inhomogeneous second order equations.
4.5 Number 1-29. **HW: 1, 5, 11**
4.5 (cont.) Number 1-29. **HW: 15, 19**
4.6 Number 1-10. **HW: 1, 3, 5**

Week 7:
Forced harmonic motion, MIDTERM 1*, Laplace Transform.*
4.7 Number 3-11. **HW: 3, 11**
MIDTERM 1
5.1 Number 1-29. **HW: 7,13,15,29**

Week 8:
Laplace Transform (cont.)
5.2 Number 1-41. **HW: 5,11,19,29**
5.3 Number 1-36. **HW: 3,7,11,19**
5.4 Number 1-26. **HW: 7,11,21**

Week 9:
Laplace Transform (cont.)
5.5 Number 1-25. **HW: 1,3,11,17**
`Wednesday`: Student Self-Care Day (no classes)
5.6 Number 1-9. **HW: 2,3,5,7**

Week 10:
Laplace Transform (cont.), Systems of differential equations.
5.7 Number 4-24. **HW: 6,8,10**
8.1 Number 1-16. **HW: 5,7,13,15**
8.2 Number 1-6, 13-16. **HW: 11,13,15 (use pplane.jar)**

Week 11:
Systems of differential equations, Constant coefficient homogeneous 2×2 systems
8.3 Number 1-6. **HW: 1,3,5**
9.1 Number 1-8, 16-23. **HW: 3,5,17,19**
9.2 Number 1-27, 58-61. **HW: 3,13,15,59**

Week 12:
MIDTERM 2*, nonlinear systems.*
9.3 Number 20-23. **HW: 21**
9.4 Number 1-12.
10.1 Number 1-16. **HW: 3,7,15**

Weeks 13:
Fourier series
12.1 Number 1-22. **HW: 5,7,13,17**
12.3 Number 1-32. **HW: 3,7,19,31**
12.4 Number 1-11. **HW: 3**

Week 14:
Separation of variables for the heat equation, Review.
13.2 Number 1-18.