MATH 351, Fall 2020

Fourier Analysis and Boundary Value Problems

Instructor: Paul Goerss

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Office hours: Wednesdays 2PM-3PM and Thursday 12:30PM-1:30PM. The latter hour is the scheduled section time.

Office hours will be on-line; for MatLab help it is best to work by e-mail.

Course Time: MWF 12.40PM synchronously over Zoom and/or in Swift Hall 107.

Overview: This is a one-quarter mathematics course in Partial Differential Equations (PDEs) and related Boundary Value Problems. The core of the course examines the heat equation and the wave equation. PDEs are a current area of research in mathematics are widespread in science, engineering, economics, and financial mathematics.

For full applicability, computers are very useful, and we will address many problems using MATLAB. This experience makes the class highly attractive to graduate programs and employers.

Read this: As of September 10, this class is scheduled to be taught in a hybrid format, meaning there will be some in-person class meetings. Learning and teaching are highly interactive and if we can hold meetings it will add considerably to the experience. However, about half the class enrolled so far has opted for a completely on-line experience. COVID infection rates for Cook County (but not Evanston) remain stubbornly high and much of campus is largely shut. We will have to decide what, if any, format for an in-person experience makes sense. See below.

1. Remote learning is possible, and even on-campus students should not attend a class if they are not well or not comfortable.

2. In the first week of the quarter (September 16 and 18) all classes are only on-line. We will decide on format for later classes at that time.

3. All classes will be synchronously on-line, will be recorded, and will be available for later review.


This is an industry-standard text available from many sources. We will be using Chapters 10 and 11, but will source material from earlier chapters, especially Chapter 2.

Numerical Solver: MATLAB is available for free for Northwestern students: see [How to obtain MATLAB](#)
This is a large program; give yourself time to download it. **Students will not be expected to have any experience with MATLAB; plenty of examples, templates, and support and examples will be provided.** If your technology is limited, please let the instructor know.

**What this course is:** Math 351 is a junior/senior level mathematics course devoted to the study of PDEs, Boundary Value Problems, and Fourier Series. A course in Ordinary Differential Equation, such as Math 250, is a prerequisite, and a course in Linear Algebra, such as Math 240, would be very helpful. Relevant material from these classes will be reviewed, but at speed. Topics will include:

1. Review of basic ODEs
2. Introduction to Boundary Value Problems
3. Fourier Series
4. The main PDEs: Heat Equation, Wave Equation, Laplace’s Equation
5. Advanced Boundary Value Problems: Sturm-Liouville Theory
6. Bessel Functions and modeling vibrations of a drum (the 2D Wave Equation).

**The Evaluation Component – Grades:** There will be no traditional timed exams. Student work will consist of regular smaller homeworks and larger projects, spaced evenly through the quarter with the last due at the end of the exam period. **Collaboration is encouraged and desirable. In order to encourage this students will be assigned to teams; teams will rotate, with changes occurring after the projects.** Teams may be be asked to give short presentations during the quarter.

Policies and procedures for completing projects will be available on Canvas.

**Canvas:** All class materials, including the syllabus, more detailed descriptions of class topics, all assignments including homework and the projects, further policies and procedures, MATLAB templates, all grades, and the class Zoom link will all be available through Canvas.

**Zoom:** All classes will be accessible virtually, over Zoom, and recorded. (See below on the University’s policy on recording.) Attendance is restricted to registered students, and the link will be available only through Canvas.

If, at any time, the internet connection fails and there is still substantial class time remaining, the instructor will try to reestablish connection for up to ten (10) minutes. If there is still no connection after that time, class will be deemed cancelled and the material will be rescheduled.
University Statements and Policies

Recording

This class or portions of this class will be recorded by the instructor for educational purposes. These recordings will be shared only with students enrolled in the course and will be deleted at the end of the Fall Quarter 2020. Your instructor will communicate how you can access the recordings.

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact AccessibleNU. Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University’s Copyright Policy, faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

Accessibility

Any student requesting accommodations related to a disability or other condition must register with AccessibleNU and provide the instructor with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential. For more information, visit AccessibleNU or call (847) 467-5530.

Discrimination and Sexual Harassment

Northwestern University’s Policies on Discrimination, Harassment, and Sexual Harassment apply to all members of the University community, including students, staff, and faculty. Any student, staff, or faculty member who believes that he or she has been discriminated against or harassed on the basis of his or her race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, parental status, marital status, age, disability, citizenship, veteran status, genetic information or any other classification protected by law, should contact the Office of Equal Opportunity and Access at (847) 491-7458 or the Sexual Harassment Prevention Office at (847) 467-6571. Additional information about the University’s discrimination and harassment policies, including the campus resources available to assist individuals with discrimination or harassment concerns, is available online on the Human Resources Equal Opportunity and Access website.

Sexual Misconduct and Reporting

Northwestern University is committed to fostering an environment where students are safe and free from sexual misconduct. Confidential resources are available to those who have experienced sexual misconduct. Faculty and instructors are not confidential resources and are required to report incidents of sexual misconduct, whether discussed in your assignments or in person, to the Title IX Coordinator, who can provide information about resources and options. Students who have experienced sexual misconduct are strongly encouraged to
talk with someone to get support. For more information, including how to request interim protective measures and academic accommodations or file a complaint, see the Get Help page.

Academic Integrity

Academic integrity is taken very seriously at Northwestern. Students are responsible for reading and understanding Northwestern’s academic integrity policies. All suspected violations of academic integrity will be reported to The Graduate School. These include: cheating, plagiarism, fabrication, unfair advantage, unauthorized collaboration, and aiding and abetting of academic dishonesty. Students found in violation of academic integrity may receive a zero on the assignment or a failing grade for the course, and may be suspended or permanently expelled from the University. See the WCAS website on academic integrity and Academic Integrity: A Basic Guide for more information.

Resources

Students can find useful resources for safety and security, academic support, and mental and physical health and well-being at the NUhelp website and app.