MATH-UA.0263-1

Partial Differential Equations

Warren Weaver Hall, room 101, Tuesdays and Thursdays, 11am - 12:15pm
Courant Institute of Mathematical Sciences
New York University
Spring Semester, 2018

Instructor

Aleksandar Donev, 1016 Warren Weaver Hall
E-mail: donev@courant.nyu.edu ; Phone: (212) 992-7315
Office hours: 2-4 pm Tuesdays, or by appointment

Recitation and Grading

11:00am-12:15pm, Friday, WWH 312, starting Feb. 2nd
Teaching assistant: Yuanxun **Bill Bao**, email: billbao@cims.nyu.edu
Office hours: Wednesday 2-4pm in 1003 Warren Weaver Hall

Course description

See Lectures for details, as well as Recitation Summary from TA. I have asked NYU ITS to **record my lectures and post them on NYUClasses** (click the MediaSite/Panopto tool in the menu on the left).

Many natural phenomena have been successfully formulated as partial differential equations: common applications include Physics, Chemistry, Biology, Economics and population dynamics. This course will be primarily focused on the theory of linear partial differential equations such as the heat equation, the wave equation and the Laplace equation, including separation of variables, Fourier series and transforms, Laplace transforms, and Green's functions. Some discussion of non-linear conservation laws and the theory of shock waves will be given as time permits. The use of computers to solve PDEs numerically (using Maple or Matlab) will also be briefly covered.

Textbooks

Required textbook: **Walter Strauss**, Partial Differential Equations: An Introduction, John Wiley & Sons, second edition, ISBN-13: 978-0470054567. This book has been used a number of times in previous semesters so there should be plenty of used copies.

The main textbook is excellent but rather terse. It does not cover all of the material I will cover, and therefore I **strongly** recommend that you supplement this book with the following two **optional** but recommended texts that are freely available ***from the NYU network*** in electronic (PDF) form or available for $25 as a soft cover MyCopy (order online) via our library subscription to SpringerLink:

1. (Functional analysis focus) David F. **Griffiths**, John W. **Dold**, David J. **Silvester**, Essential Partial Differential Equations: Analytical and Computational Aspects, ISBN: 978-3-319-22569-2, available on SpringerLink.
2. (Physics/science focus) **J. David Logan**, Applied Partial Differential Equations, Springer Verlag, 3rd edition, ISBN:978-3-319-12493-3, available on SpringerLink.

I will post a list of relevant sections to read for each class from all three books.

Another **optional** but very nice and most complete textbook that is also freely available to you in PDF format is **Peter J. Olver**, Introduction to Partial Differential Equations, available on Springer Link.

Prerequisites

Students who wish to enroll must meet the following prerequisites with a grade of C or better or the equivalent:

- Ordinary Differential Equations

This is an advanced senior-level course that will assume **mathematical maturity**. Notably, students need to be proficient in: **ODE** including systems of equations and **linear algebra** as well as the use of **complex numbers**, **vector (multivariable) calculus** including concepts such as divergence, gradient, Laplacian, Green's identities. Many derivations will only be sketched with the assumption that students can (and will!) fill in the rest independently.

Assignments and grading

There will be regular (approximately weekly) assignments due the second class of each week, a midterm and a final. No late assignments will be accepted. The grade will be 30% based on assignments, 25% on midterm (Thursday March 8th), and 45% on the final (time and place TBD).

The grade scale will be based on the percentiles:

- >92.5 = A
- 87.5-92.5 = A-
- 80.0-87.5 = B+
- 72.5-80.0 = B
- 65.0-72.5 = B-
- 57.5-65.0 = C+
- 50.0-57.5 = C
- 42.5-50.0 = C-
- <42.5 = D or F

Academic integrity policies will be strictly enforced for homework assignments. Copying homework problems from someone else is a serious violation that can lead to expulsion from your program.

Computing

In the second half of the course we will learn how to use computers to solve ODEs and PDEs. The Courant Institute has computer labs with Linux workstations that have Matlab (matlab), Maple (xmaple), Mathematica (mathematica), and other useful software installed.

Communication

There is a message and discussion board on the course NYUCourses page that will be used for messages related to the assignments and any scheduling changes. If you register for the class, you automatically have access to the message board. All course materials including lecture notes and assignments will be posted on this site as they become available.

You should feel free to email the instructor with any questions, concerns, or special requests such as meeting outside of office hours, etc.