

MA401, Applied Partial Differential Equations

Instructor

Name	: Medvinsky Michael
Lectures	: M, T, W, H, F 9:50 AM - 11:20 AM SAS 1220
Office Hours	: M, T, W, H, F right after the class in class room or by appointment
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Prerequisites: A reasonable background in calculus, ordinary differential equations, linear algebra.

Description of the course: Students will become knowledgeable about partial differential equations (PDEs) and how they can serve as models for physical processes such as mechanical vibrations, transport phenomena including diffusion, heat transfer, and electrostatics. Students will master how solutions of PDEs is determined by conditions at the boundary of the spatial domain and initial conditions at time zero.

Students will be able to understand and use inner product spaces and the property of orthogonality of functions to determine Fourier coefficients, and solution of PDEs using separation of variables. Students will master the method of separation of variables to solve the heat and wave equation under a variety of boundary conditions. Students will be familiar with the use of Fourier series for representation of functions, and the conditions for series convergence.

In addition to topical content, students will also improve their problem solving skills. Students will practice reading and interpreting problem objectives, selecting and executing appropriate methods to achieve objectives, and finally, be able to interpret and communicate results.

Note: Credit for both MA 401 and MA 501 will not be given

Text: Since this is an unusual semester, I'm adding here some online books

Official: Introduction to Applied Partial Differential Equations - John M. Davis, W.H. Freeman and Company, New York. A request for an online version was submitted to our library.

Online: Applied partial differential equations, J. David Logan, New York : Springer, [2015] (used for one chapter, available online at our library: <http://catalog.lib.ncsu.edu/record/NCSU3339742>)

Online: Partial differential equations with Fourier series and boundary value problems, Nakhle' H. Asmar. temporarily available online at our library: <https://catalog.lib.ncsu.edu/catalog/NCSU2169354>)

Online: Elementary applied partial differential equations : with Fourier series and boundary value problems, Richard Haberman. (temporarily available online at our library: <https://catalog.lib.ncsu.edu/catalog/NCSU681402>)

Exams: Dates are fixed. Please plan your schedule around these dates now.

Midterm Exam I	: Friday, May 29	(in class)
Midterm Exam II	: Friday, June 12	(in class)
Final Exam	: Wednesday, June 16, 8:00 am – 11:00 am	(in class)

Grading: Your grade will be determined by your scores on the midterm exams (40%), the final exam (30%), and homework assignments (30%).

Tentative plan of lectures: The plan may be adjusted or changed based on the actual progress.

Week	Chapters (Davis&Freeman)	Subjects
1	1.1	Introduction
	5.1	Vector Calculus Review
	1.4	ODE Review
	1.2 in Logan's	First Order PDE
2	2.1, 2.4	Orthogonal Vectors, Inner Product, Inner Product Space, Inner Product on a Function Space, Orthogonal Projection onto a Subspace with Orthogonal Basis.
	3.1, 3.4	Fourier Series Theory
	1.2, 1.3	Heat Equation: Derivation, Boundary conditions, Wellposedness
		Midterm I
3	4.1	Sturm-Liouville Theory
	2.2, 2.3, 5.6	Solving 2D Heat problem using Separation of Variables)
	5.5, 6.1	Laplace Equation in Rectangular and Polar coordinates
4	7.1	Wave equation: The Infinite String d'Alambert's Solution
	6.3	Wave equation in polar coordinates
	2.2, 2.3, 5.6	2D Wave equation, Separation of Variables
		Midterm II
5	7.4	Solving 1D infinite(opt. semi-infinite/finite) domain using Fourier Transform / Heat Kernel
		Slack time, Review

Strategies for Success:

- Attend zoom-class meetings regularly.
Read the relevant text book sections and/or additional material when given *before* you attend class. Ask questions and become involved during class sessions.
- Plan to do homework as soon as you learned the relevant material. You are encouraged to use computers to help learn and enhance the course material, as well as to solve and check homework problems. But keep in mind that your goal is to *understand* the material and that you will not have a computer with you during exams.
- Know how grades are computed at the start of the semester and plan your effort accordingly.

Mathematics Tutoring Center: Not sure what they offer during these days, but still. Free tutorial is available in Mathematics Multimedia Center (<https://www.math.ncsu.edu/mmc/>) at 2103 and 2105 SAS Hall. Hours are 8am-5pm Monday-Thursday. A schedule of tutors' hours is available at <https://www.math.ncsu.edu/mmc/tutoring.php>. A list of private tutors is available at <https://www.math.ncsu.edu/mmc/tutorinfo.php>.

Details about the content of each assignment type are as follows:

- Homework: You will be eventually given homework assignment. You should submit at least 75% of given homework.
The assignments may be updated dynamically through the course, so be sure to check the course website often to see the specific problems due. Two of a student's lowest homework scores will be dropped. Only hardcopy assignments will be accepted in person—no digital copies—and no late homework will be accepted.
- Midterm exams: Two 60-minute midterm exams will be given on selected Fridays.

- Final exam: A three-hour comprehensive exam will be given at the end of the semester.
- Letter grades are determined as follows: If X is your percentage grade, then $\{X \geq 98\% \Rightarrow A+; X \geq 92\% \Rightarrow A; X \geq 90\% \Rightarrow A-; X \geq 88\% \Rightarrow B+; X \geq 82\% \Rightarrow B; X \geq 80\% \Rightarrow B-; X \geq 78\% \Rightarrow C+; X \geq 72\% \Rightarrow C; X \geq 70\% \Rightarrow C-; X \geq 68\% \Rightarrow D+; X \geq 62\% \Rightarrow D; X \geq 60\% \Rightarrow D - X < 60\% \Rightarrow D\}$.
I reserve the right to modify these in special cases and to decide if the curve is needed.

Academic Integrity Academic Integrity: Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct at <http://policies.ncsu.edu/policy/pol-11-35-01>

Academic Honesty: See <http://policies.ncsu.edu/policy/pol-11-35-01> for a detailed explanation of academic honesty.

Honor Pledge: Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Accommodations for Disabilities Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, student must register with the Disability Services Office (<http://www.ncsu.edu/dso>) located at 1900 Student Health Center, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation at <http://policies.ncsu.edu/regulation/reg-02-20-01>

Non-Discrimination Policy NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or http://www.ncsu.edu/equal_op. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.