

Abilene Christian University

Spring 2012



MATH 440.01: Partial Differential Equations

MWF 10:00 - 10:50

Foster Science Building 239

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Course Blog: blogs.acu.edu/1220_MATH44001

Dr. John Ehrke

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Required Texts: The following text is required for this course and may be purchased in the campus book store, or ordered online at the student's discretion. Please bring this text everyday to class.

Haberman, Richard, *Applied Partial Differential Equations with Fourier Series and Boundary Value Problems*, Prentice Hall, 4th edition, 2004. ISBN 0-13-065243-1

Course Materials: A graphing calculator is recommended for this course. Calculators will not be loaned out during class and cannot be exchanged between students during tests or quizzes. The TI-83, TI-84, or TI-89 calculator are supported models. We will also make use of Maple® CAS this semester. Maple® is made available for student use in the departmental computer labs. Student editions of Maple® run about \$99 for those interested in purchasing their own versions.

Course Description: This course expands on the ideas of calculus and the techniques introduced in ordinary differential equations. The student successfully completing this course will be able to combine analytic, graphical, and numeric methods to solve problems that model a variety of physical phenomena. A *tentative* course description is included below:

MATH 440 Partial Differential Equations (3-0-3), special topics, Features analytical and computational tools of linear partial differential equations (PDEs) applied to a variety of physical models including heat/diffusion, wave, and Poisson equations. Analytic techniques include separation of variables, characteristics, transform methods, and Green's functions. Prerequisites: MATH 286, 361.

As a part of this course, students can expect to cover a wide variety of material with emphasis on analytic techniques and modeling. The course will move at a brisk pace to cover all the material possible, but we will not sacrifice mathematical rigor or appropriate depth to do so. For that reason, it is hard to judge exactly how much material we will cover, but the following list outlines the order in which we will engage the various topics.

1D Heat Equation	Chapters 1-3, 5	Separation of Variables, Fourier Series, Sturm-Liouville eigenvalue problems
1D Wave Equation	Chapters 4, 12	Method of characteristics, solutions to quasilinear PDEs, shockwaves
2D/3D Heat/Wave Equation	Chapter 7	Steady state distributions, Laplace's equation, Multidimensional eigenvalue problems
Infinite Domain Problems	Chapter 10	Fourier transform
Green's Function ¹	Chapter 9,11	Green's function methods for solving ODEs, PDEs

Mission Statement: This course supports ACU's mission statement of preparing students for Christian service and leadership throughout the world by providing students a foundational understanding of the mathematical principles such as problem solving and decision making, as well as exposing students to the role of mathematics in a Christian worldview.

Departmental Mission: The mission of the Department of Mathematics is to educate students to be quantitative and analytical thinkers in preparation for Christian service and leadership throughout the world.

¹ Subject to time. This is a very important topic for those students wishing to go to graduate school in applied mathematics or physics and is well worth your time to study even if we do not get to this material this semester.

Grading Components: This course employs a standard grading scale. The specific grading components and associated percentages are described below.

3000-2700	2400-2699	2100-2399	1800-2099	less than 1800
A	B	C	D	F

Exams (2000 points): There will be four exams this semester given outside of the normal class time. Each exam will closely resemble the homework (assigned and suggested) and cover approximately one unit of material. Each exam is graded out of 500 points and is worth 20% of your course grade. Practice exams will be made available online prior to each exam. The *tentative* exam dates are provided below, but expect these dates to change over the course of the semester.

Exam 1	1D Heat Equation and BVPs, Separation of Variables	Chapter 1-3, 5	Wednesday, February 8
Exam 2	1D Wave Equation, Quasilinear PDEs, Characteristics	Chapter 4, 12	Wednesday, March 7
Exam 3	Higher Dimensional PDEs, Laplace's equation	Chapter 7	Friday, April 13
Exam 4	Fourier Transform, Green's function methods	Chapter 10	Wednesday, May 2

Daily Work (500 points): Homework will be assigned regularly throughout the semester. Homework will normally be made available on the course blog up to one week before it is due. You will always have at least a weekend in which to complete the assignment. You can earn a maximum of 500 points toward your homework grade, but more than 500 points are available. **Homework will not be accepted late.**

Final Exam (500 points): A comprehensive final exam will be given in this course. The final exam is scheduled for 10:30 - 12:30, **Thursday May 10**. University policy prohibits the giving of any final exam early. You must take the final exam at the allotted time. Make your end of semester plans accordingly. If you do not have too many absences (see the attendance policy section) you may use your final exam to replace your lowest exam grade from the semester. The final exam comprises 20% of your overall semester grade and is worth 500 points.

Course Competencies: The course competencies, written in student performance terms, are detailed in the table below.

Competency	Measurement Instrument	Measurement Standard
Students model higher dimensional problems using appropriate terminology and notation.	In class exams, including final exam. Homework questions Maple explorations	Understand the physical forces and laws that give rise to a partial differential equation. Be able to move from one dimensional solutions to two and three dimensional problems with more complicated notations.
Students apply a variety of analytical techniques to solve a wide variety of physical models.	Emphasis on homework/exam questions to be done with the aid of a graphing calculator or Maple. Maple explorations	Analyze the appropriate technique to be used for a given problem. Demonstrate the appropriate analytic solution to a problem or explain why none can be found. Integrate multiple approaches to explain how concepts inter-relate.
Students model and solve problems in the areas of business, economics, physics, engineering, and biological sciences.	In class exams, including final exam. Homework questions Maple explorations specific to certain phenomenon.	Obtain well-articulated, analytic solutions in context with responses about the corresponding physical intuition. Appropriately model real-world phenomena in multiple dimensions with an emphasis on geometric context.

Attendance Policy: Your regular attendance is both necessary and expected. You are responsible for all material covered while absent and will be expected to take regularly scheduled exams and are responsible for turning in work on the assigned dates. Attendance will be recorded at the beginning of each class. If you come in after attendance is taken you will be counted absent. So make every effort to arrive in class on time, prepared for class. Only university approved absences can exempt you from being counted absent. Per university policy, university approved absences must be cleared with the instructor one week in advance. Make your sponsors aware that failure to comply with this policy will affect your attendance record in this class. The following actions will be taken at different absence levels:

Number of Absences	Consequences
0-5	No action taken
6-7	Students will be emailed notifying them of their current number of absences and reminding them of the attendance policies
8-11	Students with this many absences will be unable to use their final exam to replace a low test grade.
12+	Students with 12 absences will be dropped from the course.

Homework Policy: Homework sets will be assigned periodically throughout the semester. You should form the habit of doing the relevant problems between successive lectures and not try to do the whole set the night before they are due. Solutions will be made available online. I encourage collaboration in this course, but I insist on honesty about it. If you do your homework in a group, be sure it works to your advantage rather than against you. **Good grades for homework you have not thought through will translate to poor grades on exams.** You must turn in your own write-ups of all problems, and, if you do collaborate or use outside resources, you should reference them on your solution sheet. Failure to do so constitutes an act of academic dishonesty.

Make-up Policy: After an exam has been graded and handed back in class, it will not be accepted for a grade under any circumstance. In the case of a university excused absence, it is the student's responsibility to make arrangements with the instructor regarding due dates. **Exams cannot be made up if missed except under extraordinary circumstances at the discretion of the instructor.** There will not be any work accepted for extra credit.

Academic Integrity Policy: The university policy regarding academic integrity is available online at <http://www.acu.edu/campusoffices/provost>. Students found guilty of an act of academic dishonesty will be subject to the following disciplinary actions in this course.

First Occurrence: A first violation will result in no credit for that particular assignment (even if it is an exam). No makeup will be allowed. The appropriate campus office(s) will be notified of the incident, and a notice of the incident will accompany your university records.

Second Occurrence: A second violation will result in your withdrawal from the course with a grade of F. A recommendation for suspension from the university will be made by the department.

Electronic Devices Policy: Please turn off all cell phones, beepers, pagers, alarms, .mp3 players, etc... unless such devices are being used for class purposes as indicated by your instructor. Headphones, listening to music, texting, and other uses of these devices not for class purposes are strictly prohibited during class. Frequent disruptions or failure to abide by this policy will be viewed as disruptive behavior and are subject to being dismissed from class and being counted absent. If the disruptions continue you will be dropped from the course.

Disability Accommodations: If you have a documented disability and wish to discuss academic accommodations, please feel free to contact me. The ACU Student Disability Services Office (a part of Alpha Academic Services) facilitates disability accommodations in cooperation with instructors. In order to receive accommodations, you must be registered with Disability Services and you must complete a specific request for each class in which you need accommodations. Contact Disability Services at 674-2667 for further information or to set up an appointment.

Office Hours: Below is my schedule for Spring 2012. The times marked "Office Hours" represent the times I will make myself available to work with you on homework, understanding lectures, or for any other questions you might have. Please take advantage of these opportunities. If you find that none of these times work for you, feel free to email me at john.ehrke@acu.edu or call me at 674-2162 to set up an alternate appointment. No appointment is needed if you attend regularly scheduled office hours. This schedule is posted on the front of my office door as well.

Spring 2012	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 – 8:30	MATH 130		MATH 130		MATH 130
8:30 – 9:00	MATH 130		MATH 130		MATH 130
9:00 – 9:30	MATH 186		MATH 186		MATH 186
9:30 – 10:00	MATH 186		MATH 186		MATH 186
10:00 – 10:30	MATH 440	Office Hours	MATH 440	Office Hours	MATH 440
10:30 – 11:00	MATH 440	Office Hours	MATH 440	Office Hours	MATH 440
11:00 – 11:30	Lunch - Meetings				
11:30 – 12:00					
12:00 – 12:30					
12:30 – 1:00					
1:00 – 1:30					
1:30 – 2:00					
2:00 – 2:30	Office Hours		Office Hours		Office Hours
2:30 – 3:00	Office Hours		Office Hours		Office Hours
3:00 – 3:30	Office Hours		Office Hours		
3:30 – 4:00	Office Hours		Office Hours		