

Math 511
Numerical Methods for Partial Differential Equations
Winter Semester 2009

Professor: [Vianey Villamizar](#)
Office: 366 TMCB

Class: 11:00 - 11:50 a.m. MWF B112 JSFB
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Office Hours: Monday 4:00 - 5:30 p.m. (at my office) or by appointment.

Thursday 5:00 – 6:30 p.m. Problem Session at 299 TMCB

Text: *Finite Difference Methods for Ordinary and Partial Differential Equations*
by Randall J. LeVeque, SIAM, 2007.

Tentative Class Schedule

Weeks 1 – 3 (Jan 5 – Jan 23): Sections 1.1 – 1.5 and 2.1 – 2.16

Weeks 4 – 6 (Jan 26 – Feb 13): Sections 2.18 – 2.21, 3.1 – 3.7, 4.1 – 4.2, and
Grid Generation.

Weeks 7 – 9 (Feb 16 – Mar 6): Sections 4.3, 9.1 – 9.9

Weeks 10 – 12 (Mar 9 – Mar 27): Sections 10.1 – 10.13

Weeks 13 – 15 (Mar 30 – Apr 17): Acoustic Scattering and Presentations

Important Dates

- Fri Jan 16 Add/Drop Deadline.
- Monday, Jan 19: Martin Luther King Holiday
- Monday Feb 9 Withdraw Deadline
- Monday, February 16: Presidents Day Holiday
- Tuesday, February 17: Monday Instruction
- **Midterm Feb 27-28 (Fr - Sat) and Monday, Mar 2 (with late fee)**
- Reading Days: Wed-Thur, Apr 15-16
- **Final Exam: Monday, April 20 7:00-10:00 a.m. in our classroom 331 TMCB**

Pre-requisite: [Math 311](#)(410) (Introduction to Numerical Methods), [Math 343](#) (Elementary Linear Algebra), [Math 347](#) (Introduction to Partial Differential Equations); or equivalent. Computer literacy is expected. Good programming skill. Strong undergraduate linear algebra background preferred.

Course Objectives: This course is designed to prepare students to solve mathematical problems modeled by partial differential equations that cannot be solved directly using standard mathematical techniques, but which are amenable to a computational approach. Students are introduced to the discretization methodologies, with particular emphasis on the finite difference method that allows the construction of accurate and stable numerical schemes. In depth discussion of theoretical aspects such as stability, analysis, and convergence will enhance the students' understanding of the numerical methods. Students will also be required to perform programming and computation so as to gain experience in implementing the schemes and to be able to understand the numerical performance of the various numerical methods.

I believe that my role as your instructor is to help and assist you in the process of learning mathematics. I will do my best to fulfill this role. I know that we will enjoy this class as we go along by making a consistent effort throughout the semester. **My best advice to you is found in D&C 4:2 replacing the first line by ... O ye that embark in Math 511, see that ye work with all**

Homework: Homework will consist of some theoretical questions and applications of the numerical methods learned in class to some initial and/or boundary value problems. They will be more like small projects. You will need to use a computer to implement the algorithms needed for the homework. I expect that you have

good programming skills. Programming is an important part of this class. I strongly recommend that you use MATLAB as your programming language, but you can also use FORTRAN, JAVA, or C++. You need to form a team of two students to work on the homework. **Late homework will not be accepted.**

Homework website: <http://www.amath.washington.edu/~rjl/fdmbook>.

Midterm Exam and Final Project: The Midterm exam will be based on the material covered until the previous Monday. **The midterm exam will be given in the testing center on February 27-28 (Fr-Sat).** I expect that most students will finish it in at most three hours. However, the time limit will be up to four hours. Only basic scientific calculators (no graphic or symbolic ones) will be allowed in this exam. Also, a one-sided card of notes, no larger than 8" by 5", will be permitted. No books and no other notes will be allowed. Each team of 2 students will choose a **Final Project** dealing with the problems and methods learned in this class. This Final Project should be submitted no later than Monday, March 30. The teams will present their **Final Projects** starting in April 1.

Grading: Grades will be based on cumulative points earned as follows:

Final Project (Presentation-Report) 15%, Homework 40%, Midterm 20%, and Final Exam 25%.

At the end of the semester, **I will make an average based on each one of the above forms of evaluations with their corresponding weights. Then, a Gaussian curve will help me to determine your final grade.** In any event, the Gaussian curve will not hurt your grade. I will guarantee the following letter grades:

	B+ = 89-87%,	C+ = 79-77%,	D+ = 69-67%,	
A = 100-93%,	B = 86-83%,	C = 76-73%,	D = 66-63%,	E = 59-0%
A- = 92-90%,	B- = 82-80%,	C- = 72-70%,	D- = 62-60%.	

Keep in mind that a good grade is the end result of a good learning process. All of you can get a good grade by successfully experiencing this learning process.

Sexual harassment: BYU's policy against sexual harassment extends not only to employees of the university but to students as well. If you encounter sexual harassment, gender-based discrimination, or other inappropriate behavior, please talk to your professor, contact the Equal Employment Office at 422-5895 or 367-5689, or contact the Honor Code Office at 422-2847.

Students with disabilities: BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the University Accessibility Center at 422-2767. Services deemed appropriate will be coordinated with the student and instructor by that office.

TENTATIVE HOMEWORK ASSIGNMENTS
Math 511: Introduction to Numerical Methods for PDE's – Winter 2009
Instructor: Vianey Villamizar

Chapter	Problems	Due*	Chapter	Problems	Due*
1	1.1, 1.2	Mon 1/12	9-I	9.1 -9.4	
2 (I)	2.1-2.4	Mon 1/26	9-II	Others	
2 (II)	2.5-2.7	Mon 2/2	10-I	10.1 – 10.6	
3	3.1-3.2				
4-I	4.1-4.2		10-II	10.7 – 10.11	
4.2-II	GG		10-III	Others	

* Homework is due at the beginning of class on the designated Monday.