

MATH 517: FINITE DIFFERENCE METHODS (3 CREDITS, SPRING 2016)

TTh 11:00AM – 12:20PM, 184 CARVER HALL

<http://www.public.iastate.edu/~rossmani/math517/>

INSTRUCTOR	James Rossmanith Office: 482 Carver Hall Tel: (515)-294-8155 E-mail: rossmani@iastate.edu Office Hours: TTh 2:00pm-3:00pm (or by appointment)
PREREQUISITES	Math 373 or 481 or 561 (introductory class on numerical analysis) or equivalent.
COMPUTER LANGUAGE	MATLAB (MATrix LABoratory): Available in computer labs and can be freely download via IT Services. SCI PY (Scientific Python): Can be freely to download at https://enthought.com/products/canopy/academic/ .
TEXTBOOK	R.J. LeVeque, <i>Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems</i> , SIAM, 2007.
COURSE TOPICS	<ol style="list-style-type: none">1. Chap 1: Finite difference approximations2. Chap 2–3: 2-point BVPs and Poisson’s equations3. Chap 5–8: IVPs for ODEs (methods, zero-stability, absolute stability, stiffness)4. Chap 9: Heat equation5. Chap 10: Advection and wave equation6. Spectral methods: Fourier and Chebyshev methods
GRADING	35% – 6 Homework assignments 30% – 1 Midterm exam (80 minutes, in-class, no calculators) 35% – 1 Final exam (2 hours, in-class, no calculators)
CALCULATORS	No calculators are allowed on any exam.
LEARNING OUTCOMES	<ul style="list-style-type: none">• Learn how to solve standard linear partial differential equations (Poisson, heat, and wave equations) using finite difference methods.• Understand the concepts of order of accuracy, stability, and convergence in the classification of numerical methods as applied to various ODEs and PDEs.• Learn how to implement the numerical methods into computer code.• Learn the techniques to do rigorous error and stability analysis for various methods.• Learn the generalization of finite difference methods to spectral methods.• Understand the concept of high-order accuracy in relation to regularity of the underlying solution.
ATTENDANCE	I do not take attendance, but it is very likely if you skip classes that you will not do well in the course. If you decide to skip class for no good reason, then you are deciding that you are okay with missing what I teach that day. In this case, do not come to my office hours expecting me to teach you the things you missed.
READING	It is important that you read the textbook carefully for understanding. We will not be able to cover all examples and ideas in the textbook in class, but you are responsible for the content in the textbook. It is important that you read for understanding, not just to get the reading over with. This will likely mean reading each section 3 or 4 times, doing some pencil and paper work on your own to understand some transitions, etc. Reading math can be a slow process, but each section in the book is short so you will have time for multiple readings.

**DISABILITY
ACCOMMODA-
TIONS**

If you have a disability and require accommodations, please contact the instructor early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Disability Resources (DR) office, located on the main floor of the Student Services Building, Room 1076, 515-294-6624.

Class Days

WEEK	TUESDAY	THURSDAY
1	Jan. 12	Jan. 14
2	Jan. 19	Jan. 21
3	Jan. 26	Jan. 28
4	Feb. 2	Feb. 4
5	Feb. 9	Feb. 11
6	Feb. 16	Feb. 18
7	Feb. 23	Feb. 25
8	March 1	March 3
9	March 8	March 10 Midterm Exam
10	March 15 Spring Break	March 17 Spring Break
11	March 22	March 24
12	March 29	March 31
13	April 5	April 7
14	April 12	April 14
15	April 19	April 21
16	April 26	April 28

FINAL EXAM: Monday, May 2nd (9:45am–11:45am)