

SYLLABUS
MTH/CS 364/464 - Numerical Analysis
Spring 2019

Instructor: Sofya Chepushtanova

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- Class webpage: <http://chepusht.mathcs.wilkes.edu/numerical-analysis-sp2019>

Class Meetings: MWF 12:00-12:50am, room SLC 405.

Office Hours: SLC 410, MWR 10:00-10:50am and 2:00-2:50pm or by appointment.

Course Description and Objectives: This course is an introduction to numerical algorithms as tools to providing solutions to common problems formulated in mathematics, science, and engineering. Focus is given to developing the basic understanding of the construction of numerical algorithms, their applicability, and their limitations. Topics include numerical techniques for solving equations, polynomial interpolation, numerical integration and differentiation, numerical solution of ordinary differential equations, error analysis and applications.

Prerequisites: No previous experience in numerical analysis is necessary. However, the following background is required: (1) introduction to ordinary differential equations (MTH 211 or its equivalence) and (2) programming experience (CS 125 or its equivalence).

Textbook: *Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms* by Anne Greebaum and Timothy Chartier, Princeton University Press, 2012. (more details are here: <http://press.princeton.edu/titles/9763.html>).

Other Useful References:

1. R. Burden, D. Faires, and A. Burden, *Numerical Analysis*, Cengage Learning
2. E. Isaacson and H. B. Keller, *Analysis of Numerical Methods*, Dover
3. K. Atkinson, *An Introduction to Numerical Analysis*, John Wiley & Sons

Attendance: You are expected to attend classes regularly. If you skip a class, it is your responsibility to catch up any missed material, find out any announcements made during the class, and make sure your homework is turned in on time.

Homework: Homework problems will be assigned for each topic covered. Start working on assigned problems as soon as the corresponding sections are covered. Note that late homework will not be

accepted. Access to MATLAB is required to do computational homework assignments. If you have not used MATLAB previously, help resources are available on the course webpage. MATLAB is available in SLC labs 409 and 431. You can also purchase a student version of MATLAB.

You are encouraged to type your solutions using \TeX or \LaTeX , the standard in mathematical typesetting. There are versions available for you to use in the department labs. See our course webpage for tutorial and example links.

Graduate Student Presentations: MTH 464 students will deliver a 20-25 minute presentation at the end of the semester.

Exams and Grade Distribution: There will be two in-class midterm exams and a final exam. Make-up examinations will not be allowed except for extreme circumstances. It is the students responsibility to contact the instructor if an emergency situation occurs. Notice of the emergency should be made in a timely fashion and proper documentation will be required.

MTH/CS 364 student's final score in this course will be calculated as follows:
 $100\% = \text{Homework } 30\% + 2 \text{ Midterm Exams } (40\%) + \text{Final Exam } (30\%).$

MTH 464 student's final score in this course will be calculated as follows:
 $100\% = \text{Homework } 20\% + \text{Presentation } 10\% + 2 \text{ Midterm Exams } (40\%) + \text{Final Exam } (30\%).$

The final grade will be computed from the total percentage earned as follows:

| <i>Percentage</i> | <i>Grade</i> |
|-------------------|--------------|
| 90 – 100% | 4.0 |
| 85 – 89% | 3.5 |
| 80 – 84% | 3.0 |
| 75 – 79% | 2.5 |
| 70 – 74% | 2.0 |
| 65 – 69% | 1.5 |
| 60 – 64% | 1.0 |
| < 60% | 0.0 |

Drop Policy: If you wish to drop from the course, I will give my permission during the first ten weeks of the semester. Thereafter you will need the permission of the Dean. Be aware that poor performance in the course will not be a sufficient reason for the Dean's permission to be granted.

Academic Honesty: By handing in homework, quizzes, and exams you certify that this is your own work. You are encouraged to discuss homework solution strategies with fellow students but the final write-up must be your own. A violation will result in a grade of zero on that particular assignment; serious or repeated infractions of the Academic Honesty policy will result in failure of the course.

Cell Phones: Please switch the phones and other devices to silent mode or turn them off, and put out of sight during class time. NOTE: THE USE OF CELL PHONES DURING EXAMS IS EXPRESSLY FORBIDDEN AND WILL RESULT IN A GRADE OF 0.

Tentative Class Schedule Spring 2019. Dates are subject to change.

1. Week of 1/13: Introduction. Review of calculus. Computer Arithmetic.
2. Week of 1/20: Ch.4: Bisection, Taylor's theorem, Newton's method.
No class on Monday - MLK Day.
3. Week of 1/27: Ch.4: Quasi-Newton methods, fixed-point iteration, fractals.
4. Week of 2/3: Ch.8: Polynomial interpolation, divided differences.
5. Week of 2/10: Ch.8: Error in polynomial interpolation. Chebyshev points.
6. Week of 2/17: Ch.8: Hermite and cubic spline interpolation. Review and **Exam I**.
7. Week of 2/24 Ch.8: Hermite and cubic spline interpolation.
8. Week of 3/3: *No classes - Spring Recess.*
9. Week of 3/10: Ch.9: Numerical differentiation. Richardson extrapolation.
10. Week of 3/17: Ch.10: Numerical integration: Newton-Cotes formulas.
11. Week of 3/24: Ch.10: Numerical integration: Gauss quadrature, Romberg integration.
Review and **Exam II**.
12. Week of 3/31: Ch.10: Periodic functions. Singularities (improper integrals).
13. Week of 4/7: Ch.11: Initial value problem (IVP) for ODEs: Euler's method, Midpoint method, Runge-Kutta methods.
14. Week of 4/14: Ch.11: IVP for ODEs: continued.
No classes on Thursday and Friday - Holiday Recess.
15. Week of 4/21: Ch.11: IVP for ODEs: continued. Other topics of choice.
16. Week of 4/28: Review. MTH 464 student presentations: topics TBD. (Possible topics: numerical methods for linear systems, least squares, approximating eigenvalues, Fourier analysis.)
Final Exams begin on 2/5, Thursday. Final exam, due time and date: TBD.