SYLLABUS

CS/MTH 364/464 - Numerical Analysis

Spring 2021

Instructor: Dr. Sofya Chepushtanova

- Email: sofya.chepushtanova@wilkes.edu
- Office: Stark Learning Center (SLC) 408. Phone: (570) 408-4868
- Class webpage: http://chepusht.mathcs.wilkes.edu/numerical-analysis-spring2021

Class Meetings: MWF 12:00-12:50am, room SLC 424.

Office Hours: MWF 10:00-11:00 am and 02:00-03:00 pm or by appointment. *Most office hours will be held virtually.*

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

COVID-19 Safety Rules: *Always wear a mask. Wash your hands or use hand sanitizer. Sanitize your desk before class. Use the same seat in the classroom (for contact tracing purposes). No eating or drinking allowed in the classroom. If you are sick, stay at home (and let me know).* Refer to the guidelines in *COLONELS COMBAT COVID*.

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 will be available in our lab and remotely. (You can also purchase a student version of MATLAB, but you do not have to!)
You are encouraged to type your solutions using TEXor 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: CS/MTH 464 students will deliver a 20-25 minute presentation at the end of the semester.

Exams and Grade Distribution: There will be two 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.

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

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

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

Percentage	*Grade*
$90 - 100\%$	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 2021. (Dates are subject to change.)

1. Week of 2/1: Introduction. Review of calculus. Ch.2 Intro to MATLAB. Ch.5 Computer arithmetic.
2. Week of 2/8: Ch.5 Continued. Ch.4 Bisection method.
3. Week of 2/15: Ch.4 Taylor's theorem and Newton's method. Quasi-Newton methods.
4. Week of 2/22: Ch.4 Fixed-point iteration. Fractals.
5. Week of 3/1: Ch.8 Polynomial interpolation: Lagrange and Newton forms.
6. Week of 3/8: Ch.8 Divided differences. Error in polynomial interpolation. Chebyshev points.
7. Week of 3/15: Ch.8 Hermite and cubic spline interpolation. *Exam I.*
8. Week of 3/22: Ch.8 Continued.
9. Week of 3/29: Ch.9 Numerical differentiation. Richardson extrapolation. *Holiday Recess: 4/1-4/4 $\Rightarrow$ no class on Friday.*
10. Week of 4/5: Ch.10 Numerical integration: Newton-Cotes formulas.
11. Week of 4/12: Ch.10 Numerical integration: quadrature formulas. Gauss quadrature.
12. Week of 4/19: Ch.10 Romberg integration. Periodic functions. Singularities (improper integrals). *Exam II.*
13. Week of 4/26: Ch.11 Initial value problem (IVP) for ODEs: Euler's method, Midpoint method, Runge-Kutta methods. *No class on 4/28, Wednesday.*
14. Week of 5/3: Ch.11 Continued.
15. Week of 5/10: More from Ch. 11. MTH 464 student presentations. (Possible topics: numerical methods for linear systems, least squares, approximating eigenvalues, Fourier analysis.) Classes end on 5/13. *Final Exams begin on 5/15, Saturday.* (*Final exam date: TBD.*)
16. Week of 5/17: *Final Exams end on 5/21, Friday.*