SYLLABUS

MTH/CS 364/464 - Numerical Analysis

Fall 2016

Instructor: Sofya Chepushtanova

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- Office: Stark Learning Center (SLC) 410. Phone: (570) 408-4868
- Class webpage: http://chepusht.mathcs.wilkes.edu/numerical-analysis-fall2016

Class Meetings: MWF 2:00-2:50am, room SLC 403

Office Hours: SLC 410, MWF 10:00-10:50am and TTh 1:00-1:50pm 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 miss a class, it is your responsibility to obtain notes from a classmate, find out any announcements made during the class, and make sure your homework turned in on time. Five or more unexcused absences may result in an F for the course.

Homework: Homework problems will be assigned for each topic covered. Start working on assigned problems as soon as the 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.

Presentation: Each MTH 464 student will receive a topic for a 20 to 25 minute presentation to be delivered to the class.

Exams and Grade Distribution: There will be two in-class midterm exams and a comprehensive take-home 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 final score in this course will be calculated as follows:
100% = Homework 30% + 2 Exams (40%) + Final Exam (30%),

MTH 464 student final score in this course will be calculated as follows:
100% = Homework 20% + Presentation 10% + 2 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.

Tentative Class Schedule Fall 2016

1. Week of 8/29: Introduction. Review of calculus. Computer Arithmetic. Ch.4: Bisection.
2. Week of 9/5: Ch.4: Taylor's theorem. Newton's method. *No class on Monday - Labor Day.*
3. Week of 9/12: Ch.4: Quasi-Newton methods, fixed-point iteration, fractals.
4. Week of 9/19: Ch.8: Polynomial interpolation, divided differences.
5. Week of 9/26: Ch.8: Error in polynomial interpolation. Chebyshev points.
6. Week of 10/3: Ch.8: Hermite and cubic spline interpolation. Review and **Exam I**.
7. Week of 10/10 Ch.8: Hermite and cubic spline interpolation. *No classes Thursday and Friday - Fall Recess.*
8. Week of 10/17: Ch.9: Numerical differentiation. Richardson extrapolation.
9. Week of 10/24: Ch.10: Numerical integration: Newton-Cotes formulas.
10. Week of 10/31: Ch.10: Numerical integration: Gauss quadrature, Romberg integration.
11. Week of 11/7: Ch.10: Periodic functions. Review and **Exam II**.
12. Week of 11/14: Ch.10: Singularities (improper integrals), Ch.11: Initial value problem (IVP) for ODEs: Euler's method.
13. Week of 11/21: Ch.11: IVP for ODEs: Midpoint method, Runge-Kutta methods.
14. Week of 11/28: Ch.11: Continue on methods for IVP. *No classes Wednesday through Friday - Thanksgiving Recess. Tuesday follows Thursday schedule.*
15. Week of 12/5: Topics TBD. MTH 464 student presentations. (Possible topics: numerical methods for linear systems, least squares, approximating eigenvalues, Fourier analysis.)
16. Week of 12/12: Review. *Monday (last day of class) follows Friday schedule.* **Take-home final exam, due time and date: TBD.** *Final exams end on Wednesday, December 21st.*