Tufts University
Department of Mathematics

MA 126 **Numerical Analysis** Fall 2018

Course Information (V1.1)

Class times and location: Mon, Wed, 1:30 – 2:45 pm (Block G+), BP 007.

Office hours: Professor Boghosian's hours will be held in Room BP-211 on Mondays [1], from 3:00–6:00 pm, beginning on Monday 10 September. Unless otherwise announced, I will surely be in my office and available at that times. If you need to see me outside of office hours, you are welcome to try, and if I am free I will be happy to speak with you, but please understand that I might not be free. If I am not, we can usually schedule another mutually convenient time.

In addition, our grader, Elizabeth Newman, will hold office hours to also help you with the homework assignments and any other questions you may have on Thursdays from 11:00 am until 12:30 pm. Elizabeth's office is in BP-216.

Text: K. Atkinson, W. Han, "Elementary Numerical Analysis," Wiley (2004).

Prerequisites: MA51 or MA 155 and programming ability in, e.g., C, C++, Fortran, *Matlab*, or *Mathematica*.

Students who prefer other computer languages may use those, of course, but then they are responsible for all usage questions, and for making their assignments comprehensible to the grader. When the instructor provides course material and solutions to problems, they will usually be written in *Mathematica*. Examples in the book are provided in *Matlab*.

The *Matlab* and *Mathematica* software packages are available to all Tufts students by the terms of site licenses; instructions for obtaining them can be found here and here, respectively.

Live, hands-on, two-hour *Mathematica* tutorials will be provided by Wolfram Research on September 6, 13, 18 and 25, and you should register to participate in one of those; more information about this is available here.

Exams: There will be a take-home midterm and an in-class final examination, the format of which is to be announced. The final exam will be held on Friday 14 December from 12:00-2:00 pm.

Homework and exams: If you wish to succeed in this course, you simply *must* do the homework. There is really no other way. Homework will be distributed weekly, usually on Fridays, and will be due *at 3:00 pm* on the following Friday. Late homework will not be accepted. Homework should be left in the wooden drawer labeled with our course number on the right-hand side as you enter the first floor of Bromfield-Pearson from the north stairwell.

Please look at the homework carefully on the weekend immediately after the Friday when it is distributed, so that you have an advance idea of those areas for which you will need help, and can ask questions during office hours on the following Monday. Be sure to observe this schedule carefully, and do not wait until the morning the assignment is due to ask me your questions.

[1] Office hours will be shared with my other class, MA 10-01.

The homework that you turn in is expected to be your work and yours alone. Helping your peers and seeking help from them is allowed – indeed encouraged; by contrast, mindlessly copying answers is highly unethical. Be certain that you are able to explain anything and everything that you turn in, and that it is your intellectual property and yours alone.

Please be sure to include your name (or some other unique identifier known to the grader) on your assignment, so that the grader will know to whom to give credit. Please be aware that, while homework will be handled by the instructor and grader as discreetly as possible, absolute confidentiality is not guaranteed; if you would like to exercise your full rights to confidentiality under the Family Educational Rights and Privacy Act, please make arrangements with the instructor at the beginning of the semester.

Grades: Your final course grade will be determined by your homework (50%), your midterm exam (15%), your final exam (25%) and your class participation (10%). The numerical score thus obtained may or may not be scaled before it is converted to a letter grade. The instructor reserves the right to decide whether or not to scale grades until the very end of the semester.

Student Accessibility Services: If you are requesting an accommodation due to a documented disability, you must register with the Disability Services Office at the beginning of the semester. To do so, call the Student Accessibility Services office at 617-627-4539 to arrange an appointment with the Program Director of Student Accessibility Services.

Course description: We will study, inter alia, numerical methods for function evaluation, root finding, interpolation and approximation, integration and differentiation, ordinary differential equations, and partial differential equations. Many examples of applications will be discussed throughout the course. Computer pro- gramming is a central part of the work you will be required to do.

There will be 3.0 academic hours of instructor-led class time per week [2].

Course learning outcomes: Referring to the Mathematics Learning Objectives on the web page of the Office of the Secretary of the Faculty, this course especially addresses items 1 and 2.

Some class rules: The following rules are intended to make the class a pleasant and intellectually enriching experience for all of us.

- Please arrive on time for class so that you do not disturb your classmates and the instructor by arriving late. Please wait until the end to leave for the very same reason. While you are in the class, please stay focused on the course material.

- Questions and interaction are encouraged. If you do not understand something the instructor is saying, chances are that others also do not, so please raise your hand and ask for clarification.

- Please do not use electronic communication devices in the classroom, as they often distract people around you. Turn off all cell phones while in class so that ringing, chiming, buzzing, submarine pings, etc. do not interrupt the lecture. Your e-mail, Facebook page and other social media can wait until class is over. Never answer any

[2] An "academic hour" is defined by our accreditors as 50 minutes.

electronic communications media in class, nor should you step outside just to answer electronic communications. Please reserve our class time for our class, and our class alone, and focus your thoughts on the course while you are in class.

- You do *not* have my permission to post photos or recordings of this class on social media, or propagate them in any other fashion. You also do *not* have my permission to distribute or propagate our class material, such as that made available to you on Canvas, to anybody else at all.
- You will have approximately a week to complete your homework assignments, and it is important that I be able to post solutions soon after assignments are turned in, so late homework will not be accepted.
- Congratulations! You have reached that critically important point in your learning career where I have the right to expect you to contact me and seek help from me if you find yourself falling behind. When you do so, please know that I will be there to help you to the very best of my ability.

Modifications to syllabus: The information in this syllabus is subject to change with notice at any time during the semester.

Date	Topic	Atkinson & Han sections
09/05/18	Taylor polynomials	1.1, 1.2, 1.3
09/10/18	Floating-point numbers, errors	2.1, 2.2
09/12/18	Propagation of error, summation	2.3, 2.4
09/17/18	Bisection	3.1
09/19/18	Newton's method	3.2
09/24/18	Secant method	3.3
09/26/18	Fixed-point iteration	3.4
10/01/18	Ill-behaving root-finding problems	3.5
10/03/18	Polynomial interpolation	4.1
10/09/18	Error in polynomial interpolation	4.2
10/10/18	Interpolation using spline functions	4.3
10/15/18	The best approximation problem	4.4
10/17/18	Chebyshev polynomials	4.5
10/22/18	A near-Minimax approximation method	4.6
10/24/18	Least-squares approximation	4.7
10/29/18	The trapezoidal and Simpson rules	5.1
10/31/18	Error formulas	5.2
11/05/18	Gaussian numerical integration	5.3
11/07/18	Numerical differentiation	5.4
11/14/18	Intro to ODEs, Euler's method, convergence	8.1, 8.2, 8.3
11/19/18	Numerical stability, implicit methods	8.4
11/26/18	Taylor, Runge-Kutta, and multistep methods	8.5, 8.6
11/28/18	Systems of ODEs	8.7
12/03/18	Two-point boundary-value problems	8.8
12/05/18	The Poisson Equation	9.1
12/10/18	One-dimensional heat equation	9.2