

MST 383/683
Topics Course on Numerical Methods for Differential Equations
Fall 2020

Class Times: TTh 3:30-4:45 pm, Carswell 102

Instructor: Dr. Kaitlin Hill, Manchester 385, hillk@wfu.edu

Office hours: TBD; for now, MWF 3-4pm and TW 8-9am (online only)

Website: All course materials, links, and grades will be posted on Canvas

Course prerequisites: MST 113 (Calculus III) and MST 121, 205, or 206 (Linear Algebra); or POI

Course materials: ¹*Numerical Solution of Ordinary Differential Equations*, by Atkinson, Han, and Stewart

Objectives: During this course, students will develop their skills in analyzing differential equations and numerical approximation schemes using methods of numerical analysis. These skills include:

- ❖ Applying numerical methods to approximate solutions to differential equations problems, including stiff differential equations, differential algebraic equations, and boundary value problems
- ❖ Critically evaluating numerical methods and when to use different methods, such as implicit and explicit Euler methods, Runge-Kutta methods, and multistep methods
- ❖ Numerically approximating solutions to differential equations models and interpreting the results in context
- ❖ Communicating mathematical and numerical results in orally and writing

Computer Software

Several assignments will have a computational component. We will primarily use Matlab, which can be downloaded for free at software.wfu.edu. Prior coding experience is not required.

Projects

Course projects are designed to expand your understanding numerical methods, their derivation, and when and how to apply them. Written work must consist of solutions that show all steps, be your own work, and be written clearly and concisely, using complete sentences as appropriate (see the *project guidelines*). Collaboration is encouraged on forming ideas and strategy for work or code, but submitted solutions and code must be your own work. When used, all collaborators must be cited.

Projects will be graded out of a total of 40 points. **Late work will not be accepted** without prior approval or documentation from the health center or doctor regarding an illness. Re-submissions will be accepted for at most two projects, up to a week after receiving graded work back.

Final Project

There will be a final project, due during finals week. While the projects are designed to assess your understanding of specific course topics, the final project is meant to assess your ability to apply skills learned in a less-structured setting. The final project will not be collaborative.

The final project will consist of several applications, and you will use course material learned to fully analyze these scenarios. You will submit a final writeup of your analysis, written as a technical lab/report. Graduate students will be required to complete all problems, while undergraduates will be responsible for a subset of problems, which they may choose between. Alternatively, you may complete a self-designed final project, consisting of three components: (1) a topic proposal, chosen from a list of topics or research papers; (2) a brief presentation of your analysis and results; and (3) a final writeup of your analysis, written as a technical/lab report.

¹ Available for free through the [ZSR library](#) or Atkinson's [website](#).

Participation

The participation of each person in class is vital to both individual success and the success of the class as a whole. Mathematics is best learned when actively engaging with the material, including during class time. It is thus vital that you attend class and participate in in-class discussions and groupwork, not only for your own benefit, but also for the benefit of your colleagues. Toward this effort, I promise to cultivate a culture of inclusivity and mutual respect, and I expect the same from each person in the class. In-class, using a laptop or other device during class for tasks unrelated to the course will be considered a violation of this policy and counted against your participation grade. Everyone will be expected to participate in online class discussion threads and prompts – this is doubly important to demonstrate your participation if you are only accessing the course online.

To align course policy with grading policy, I will count your active participation in in-class and online activities toward your grade.

Attendance

As long as our enrollment does not exceed classroom capacity, we will have two cohorts: an In-person Cohort and an Online Cohort. If you want to switch to online-only or in-person at any point, let me know. Face masks will be required at all in-person activities, until further notice.

Tentative Course Schedule

Week	Dates	Sections	Major Events
1	8/26 – 8/28	1.1	
2	9/31 – 9/04	1.2-1.3	
3	9/07 – 9/11	2.1-2.2	9/10: Project 1 due
4	9/14 – 9/18	2.3-2.4	
5	9/21 – 9/25	3.1-3.2	9/24: Project 2 due
6	9/28 – 10/02	4.1-4.2	
7	10/05 – 10/09	5.1-5.2	10/08: Project 3 due
8	10/12 – 10/16	5.3-5.4, 5.6	
9	10/19 – 10/23	6.1-6.2	10/22: Project 4 due
10	10/26 – 10/30	8.1	
11	11/02 – 11/06	8.2	
12	11/09 – 11/13	PDEs	11/12: Final project topic proposal due (MST 683 only)
13	11/16 – 11/20	PDEs	11/19: Project 5 due
14	11/23 – 11/24	PDEs	
<i>11/25 – 11/29: Thanksgiving Break</i>			
15	11/30 – 12/04	PDEs	12/12, 2:00 pm EST: Final project due

Course Grade Breakdown

Projects	60%
Final Project	30%
Participation	10%

Letter grades will be assigned according to this grade scale:

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	66-69	63-65	60-62	< 60

Resources

Here are some resources I would encourage you to use throughout the semester (in no particular order):

- ❖ **Colleagues:** You are welcome to work together to formulate ideas and work toward a solution on projects. However, any work and code submitted must reflect your own work and be written in your own words. You are welcome to *check* your solutions with others. You are not allowed to collaborate with others on the final project.
- ❖ **Office hours:** Feel free to stop by my office or Zoom room during office hours. If none of the hours work with your schedule, let me know and we can set up an appointment. I am happy to help with any course-related questions, or discuss any issues you may be having in general.

Synchronous Learning

This course is designed to be synchronous for the benefit of all participants. Unless I approve it, students attending class online *must* attend synchronously. Otherwise, I will count any absence from class as if we were in-person, and it will impact your participation grade. Students who need to attend the course asynchronously will participate in in-class activities synchronously at an alternate time from the synchronous cohorts. These times will be arranged with me beforehand.

Disability Accommodations

Wake Forest University provides reasonable accommodations to students with disabilities. If you are in need of an accommodation, please consult the Learning Assistance Center (118 Reynolda Hall, 336-758-5929, lac.wfu.edu), then contact me, ideally within the first two weeks of class. Retroactive accommodations will not be provided.

Academic Honesty

At Wake Forest, we expect you to behave as honorable citizens of the class, the university, and the world as a whole. When you complete an assignment with your name on it, you are representing that everything you are turning in is your own work. That means that you have not copied from or paraphrased other students' work, books, or websites. Any cheating or plagiarism in this course will result in a zero for the assignment, and I will submit the information to the Honor and Ethics Council.

College Fall 2020 COVID-19 Syllabus Statement:

Each of us shares responsibility for the health and safety of all in a learning space. Maintaining a consistent six feet of distance; wearing a face covering; limiting our gathering sizes; and isolating or quarantining when ill or exposed to someone with the virus are Wake Forest University directives and policies we all must follow. Students are encouraged to visit [Our Way Forward](#) to stay informed about the latest guidance and review the [Public Health Emergency Addendum to the Student Code of Conduct](#). Specifically, in this room, we will mitigate the risks of virus transfer and take care of our community by abiding by the following safety directives:

- maintain six feet of distance at all times when feasible.
- wear a face covering for the entirety of class. This face covering should cover your mouth and your nose. A face shield without a face covering is not an acceptable substitute for a face covering.
- stay out of class when sick or after being exposed to someone who is sick.

In this class, any student who does not follow these requirements will be asked once to follow the safety directives. I will offer you a mask or ask you to find one. If you do not comply, I will ask you to leave the class for that day. I will also refer the matter to the COVID-19 compliance reporting system. Possible disciplinary actions may follow as described in the Wake Forest University Undergraduate Student Conduct Code Public Health Emergency Addendum.