MATH 170 – Spring 2026
Introduction to Scientific Computing (Python)

General Information

Please note:

1. The information in this syllabus is subject to change at any point in the semester, as deemed necessary by the instructor.[1] Any changes will be communicated to the students both in class and via email in a timely fashion. For the latest version of this document, please check the course page on Canvas or on class webpage.
2. This course introduces core concepts in scientific computing using Python and the scientific Python ecosystem. By the end of this course, students should be able to:
   - Translate mathematical problems into implementable algorithms.
   - Write clear Python programs using functions, modules, and classes.
   - Use NumPy, SciPy, and Pandas for scientific computations.
   - Visualize data and results with Matplotlib.
   - Understand the mathematical foundations of neural networks.
   - Build and train simple neural networks using PyTorch.
   - Use Jupyter notebooks and Git to produce reproducible work.
3. The prerequisite is pre-calculus (no prior programming experience assumed). Contact the course instructor if you have any questions.

- **Instructor:** Tianshi Xu <tianshi.xu@emory.edu>.
- **Class Schedule:** MW 2:30 – 3:45 PM, MSC W307C; Lab F 1:00 – 1:50 PM, MSC W307C (all times in Atlanta, GA).
- **Instruction Method:** In person, unless there are special circumstances.
- **Office Hours:** M 4:00 – 5:00 PM, F 2:00 – 3:00 PM, MSC N436.

Materials and Tools

- **Canvas Page:** Course announcements, notebooks, assignments, and submission links will be posted on Canvas: https://canvas.emory.edu. It is your responsibility to visit

[1] Last Updated: February 14, 2026

the website periodically.

- **Textbook:** We use an open access textbook:
  - J. Sundnes, Introduction to Scientific Programming with Python (Springer Open), https://link.springer.com/book/10.1007/978-3-030-50356-7
- **Lecture Notes:** Jupyter notebooks and lab instructions will be posted on Canvas (see also course materials under `MATH170/` in this repository).
- **Tech Requirements:** It is recommended that you have access to:
  - A computer with reliable internet access. You should be able to access Canvas, Google Colab, GitHub Classroom/GitHub, and a cloud environment (e.g., lightning.ai).
  - A Google account (for Colab) and a GitHub account (free) may be required.
  - VS Code (recommended) or another code editor.
  - A way to scan/take photos of handwritten work if needed.

Grading Information

- **Grade Distribution:**

Final Exam	30 %
Midterm Exam	30 %
Graded Labs	20 %
In-class Quiz	20 %
Total	100 %

- **Grading Scale:** Your final grade will be decided based on the following scale:

		B+:	[87,90)	C+:	[77,80)	D+:	[67,70)		
A:	[93,100]	B:	[83,87)	C:	[73,77)	D:	[60,67)	F:	[0,60]
A-:	[90,93)	B-:	[80,83)	C-:	[70,73)				

The class may be curved at the end at the discretion of the instructor. However, your final course grade will be no worse than your actual grade. That is, we will never "curve down". As a result, the course grade will not be rounded up. For example, a course grade of 92.99% is strictly 92.99% (and hence an A-).

- **Honor Code:** Students are required to follow the Emory University Honor Code throughout the semester. Details can be found at Emory Honor Code.
- **Attendance:** Attendance is not required but strongly recommended. Please maintain a respectful and professional demeanor if you come to class.

- **Graded Labs:** Labs will be completed during the Friday lab session. Submissions will be handled via GitHub Classroom (typically as a repository containing a Jupyter notebook `.ipynb` and/or Python source files `.py`). Submission instructions and due dates will be posted on Canvas. The two lowest lab scores will be dropped.
- **Late Submissions (Homework and Labs):** Late submissions will be accepted for up to two days after the due date, with a 20% penalty per day. Submissions later than two days will receive no credit.
- **In-class Quiz:** You will have roughly one in-class quiz every two weeks. The quiz will be taken in class during the first 10 minutes. No make-up quiz will be provided. The lowest quiz will be dropped.
- **Midterm Exam:** There will be one midterm exam. It must be taken during the lecture. Makeup midterms will be given only in extreme situations. You must notify the instructor at least two weeks before the midterm if you have a conflict, or have a valid excuse verified by the Office of Undergraduate Education (OUE).
- **Final Exam:** The final exam will be scheduled during the official final exam period (Apr 28–May 8, 2026). Details (date/time/location) will be announced on Canvas.

Student Success Resources

- **Tech Support:** For technical assistance, refer to Emory IT Services.
- **Undergraduate Education Resources:** The Office of Undergraduate Education offers various student support services including academic advice, peer tutoring, and guidelines for missed exams. More information is available at OUE Emory.
- **Accessibility Services:** Students with documented disabilities or who suspect they may have a disability should reach out to the Office of Accessibility Services for accommodation support and resources. Confidentiality regarding any disability-related information is assured. Further details can be found at Office of Accessibility Services Emory.
- **Academic and Religious Observance Calendar:** Please familiarize yourself with the Academic Calendar for crucial academic dates.
- **EPASS:** Emory has an excellent peer tutoring program that can be extremely helpful. For information, visit Learning and Peer Assistant Tutoring.
- **Netiquette:** When using online tools for this course, please be courteous to other students and instructors.
- **Health and Wellness Resources for Students:** Achieving academic success is closely linked to maintaining a healthy lifestyle, both mentally and physically. Emory University offers several no-cost resources to support student well-being:

  - Emory HelpLine: For non-critical mental health needs, students can reach out to the Emory HelpLine at 404-727-4357. This confidential, peer-run phone counseling service operates every evening from 8:30 pm to 1:00 am.
  - For immediate mental health concerns, the Student Counseling Center is available at 404-727-7450.
  - This program supports students dealing with sexual assault, relationship violence, or stalking. Confidential consultations, crisis intervention, and referrals are provided. Contact them at 404-727-1514.
  - Offering a broad range of services including primary care, physical exams, dietary and substance abuse counseling, Emory Student Health is committed to supporting students' physical health.

- **Policy on Harassment:** As per Emory Equal Opportunity and Discriminatory Harassment Policy, Emory University strictly prohibits any form of discriminatory harassment. This includes sexual harassment and harassment based on race, color, religion, ethnic or national origin, gender, genetic information, age, disability, sexual orientation, gender identity, gender expression, veteran status, or any other category protected under applicable law. This policy applies to faculty, staff, administration, students, vendors, contractors, guests, and patrons on campus.

Tentative Topics

Week	Topic
Week 1	Course overview; GitHub, VS Code, Colab, and cloud environments
Week 2	Python basics: variables, data types, control flow, and working in notebooks vs scripts
Week 3	Functions and loops; data structures; modular code; basic Git workflow for programming assignments
Week 4	Vectors and NumPy arrays; vectorization
Week 5	Matrices and linear systems
Week 6	Python project architecture; testing with `pytest`; vibe coding with AI

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Week	Topic
Week 7	Pandas for data analysis; Matplotlib visualization
Week 8	Root finding: bisection and Newton's method; Midterm Exam (Wed, Mar 4)
Week 9	Spring break
Week 10	Random number generation and Monte Carlo methods; SciPy overview and sparse matrices
Week 11	Data fitting and least squares; images as arrays and filtering
Week 12	Object-oriented programming; PyTorch tensors introduction
Week 13	Neural network basics: MLP forward pass; introduction to back-propagation
Week 14	CNN forward pass and convolution; introduction to graphs
Week 15	JAX and automatic differentiation; ordinary differential equations
Week 16	Physics-Informed Neural Networks (PINNs); course wrap-up

Tentative Schedule

Red: Quiz, exam, or holiday

Blue: Potential Remote Class

Orange: Lab out

Purple: Lab due

Week	Monday	Wednesday	Friday (Lab)
Week 1	No Class: 01/12/26 Before classes begin No Class	Lecture 1: 01/14/26	Lab: 01/16/26
Week 2	No Class: 01/19/26 Martin Luther King holiday No Class	Lecture 2: 01/21/26	Lab: 01/23/26
Week 3	Lecture 3: 01/26/26	Lecture 4: 01/28/26 Quiz 1	Lab: 01/30/26 Lab 1 out
Week 4	Lecture 5: 02/02/26	Lecture 6: 02/04/26	Lab: 02/06/26 Lab 1 due Lab 2 out
Week 5	Lecture 7: 02/09/26	Lecture 8: 02/11/26 Quiz 2	Lab: 02/13/26 Lab 2 due Lab 3 out
Week 6	Lecture 9: 02/16/26	Lecture 10: 02/18/26	Lab: 02/20/26 Lab 3 due Lab 4 out
Week 7	Lecture 11: 02/23/26	Lecture 12: 02/25/26 Quiz 3	Lab: 02/27/26 Lab 4 due Lab 5 out
Week 8	Lecture 13: 03/02/26	Lecture 14: 03/04/26 Midterm Exam	Lab: 03/06/26 Lab 5 due Lab 6 out
Week 9	No Class: 03/09/26 Spring Break No Class	No Class: 03/11/26 Spring Break No Class	No Class: 03/13/26 Spring Break No Class

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Week	Monday	Wednesday	Friday (Lab)
Week 10	Lecture 15: 03/16/26	Lecture 16: 03/18/26 Quiz 4	Lab: 03/20/26 Lab 6 due Lab 7 out
Week 11	Lecture 17: 03/23/26	Lecture 18: 03/25/26	Lab: 03/27/26 Lab 7 due Lab 8 out
Week 12	Lecture 19: 03/30/26	Lecture 20: 04/01/26 Quiz 5	Lab: 04/03/26 Lab 8 due Lab 9 out
Week 13	Lecture 21: 04/06/26	Lecture 22: 04/08/26	Lab: 04/10/26 Lab 9 due Lab 10 out
Week 14	Lecture 23: 04/13/26	Lecture 24: 04/15/26 Quiz 6	Lab: 04/17/26 Lab 10 due Lab 11 out
Week 15	Lecture 25: 04/20/26	Lecture 26: 04/22/26	Lab: 04/24/26 Lab 11 due
Week 16	Lecture 27: 04/27/26 Last Day of Classes	No Class: 04/29/26 Final Exam Period No Class	No Class: 05/01/26 Final Exam Period No Class