

Syllabus subject to change

CS 450: Numerical Analysis

Course Description

Numerical solution of mathematical problems arising in computational modeling and data analysis, including proper problem formulation, selection of effective solution algorithms, and interpretation of results. First half of course focuses on algebraic problems, including linear and nonlinear algebraic equations, eigenvalue problems, and optimization. Second half of course focuses on analytic problems, including numerical integration and differentiation and initial and boundary value problems for differential equations. Prerequisites include linear algebra, multivariate calculus, and basic programming ability, preferably using Python. No prior familiarity with numerical methods is assumed.

Course Prerequisite

- Linear algebra
- Multivariate calculus
- Basic programming ability using Python

Course Goals

By the end of the course, you will be able to:

- Learn how to formulate computational problems properly
- Learn how to select an effective solution algorithm for a given problem
- Learn how to interpret computational results properly

Textbook (Recommended but not required)

Michael T. Heath. [*Scientific Computing, Second edition*](#), The McGraw-Hill Companies.

Course Schedule

Week	Topic
1	Scientific Computing
2	Systems of Linear Equations
3	Linear Least Squares
4	Eigenvalue Problems
5	Nonlinear Equations
6	Optimization
7	Midterm
8	Interpolation
9	Numerical Integration and Differentiation
10	Spring break, No class
11	Initial Value Problems for Ordinary Differential Equations
12	Boundary Value Problems for Ordinary Differential Equations
13	Partial Differential Equations
14	Fast Fourier Transform
15	Random Numbers and Stochastic Simulation
16	Final

Elements of This Course

The course is comprised of the following elements:

About the course: this 4-credit hour course is 16 weeks long. The course is composed of two parts, with the part 1 starting from week 1 to week 7 with the conclusion of a midterm exam. The part 2 starts from week 8 until week 16, with a final exam in the end. For details about each component of the course, see the course component description below.

Lecture videos: in this course, content will be presented as lecture videos. Each week's content is broken into several short-duration videos. Each lecture video is no longer than 30 minutes. You may stream lecture videos for playback within the browser by clicking on their titles, or you may download the lecture videos and watch them offline. You can also download each lecture PowerPoint by clicking the Resources tab in each lecture video.

Quizzes: each week has a low-stakes quiz. The quiz gives you as a student the opportunity to practice what you learn from the lecture videos. The quiz is graded and each counts for 1% of your overall course grade. You may take each quiz as many times as you wish and the only deadline is that quizzes must be submitted by the final day of the course.

Programming Assignment: each week also includes a short programming assignment in which you use or implement the techniques described in the lecture to solve problems. The assignments require the use of the Python programming language.

Midterm and Final Exam: The midterm exam and final exam are proctored exams. The exams can be only taken during specific window. The final exam is cumulative, with a strong emphasis on the second half of the topics that are built upon the knowledge from the first half of the topics. For more information about the proctored exams, read the Proctored Exam section in the orientation module.

Please note, in order to access course materials and assignments, you will need to pay the Coursera fee (\$158) for this course in addition to the University of Illinois tuition.

Assignment Deadlines

For all assignment deadlines, please refer to the Course Deadlines, Late Policy, and Academic Calendar page.

Grading Distribution and Scale

Grading Distribution

Your final grade will be calculated based on the activities listed in the table below. Your official final course grade will be listed in [Enterprise](#). The course grade you see displayed in Coursera may not match

your official final course grade. Grades that fall directly on a threshold will be rounded up to the higher letter grade (e.g. 90 percent is an A- not a B+)

Assignments	Occurrence	Weight Percentage
Graded Quizzes	13	13%
Programming Assignments	13	26%
Midterm Exam	1	26%
Final Exam	1	35%
Total		100%

Grading Scale

Total (percentage)	Grade
90-100 (90-93, 93-96, 96-100)	A (A-, A, A+)
80-90 (80-83, 83-86, 86-90)	B (B-, B, B+)
70-80 (70-73, 73-76, 76-80)	C (C-, C, C+)
60-70 (60-63, 63-66, 66-70)	D (D-, D, D+)
Below 60	F

Student Code and Policies

A student at the University of Illinois at the Urbana-Champaign campus is a member of a University community of which all members have at least the rights and responsibilities common to all citizens, free from institutional censorship; affiliation with the University as a student does not diminish the rights or responsibilities held by a student or any other community member as a citizen of larger communities of the state, the nation, and the world. See the University of Illinois Student Code for more information.

Academic Integrity

All students are expected to abide by the campus regulations on academic integrity found in the Student Code of Conduct. These standards will be enforced and infractions of these rules will not be tolerated in this course. Sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. We will be actively looking for violations of this policy in homework and project submissions. Any violation will be punished as severely as possible with sanctions and penalties typically ranging from a failing grade on this assignment up to a failing grade in the course, including a letter of the offending infraction kept in the student's permanent university record.

Again, a good rule of thumb: Keep every typed word and piece of code your own. If you think you are operating in a gray area, you probably are. If you would like clarification on specifics, please contact the course staff.

Disability Accommodations

Students with learning, physical, or other disabilities requiring assistance should contact the instructor as soon as possible. If you're unsure if this applies to you or think it may, please contact the instructor and Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, via phone at (217) 333-1970, or via email at disability@illinois.edu.