

Course Title

Numerical Analysis

Course Number: MATH-UA 9252**Instruction Mode:** In-person**Fall 2026****Syllabus last updated on:** 11 September 2026

Lecturer Contact Information

Urbain VAES

uv2013@nyu.edu

Office hours: Mondays, 2:30pm to 3:30pm, Room 606

Prerequisites

The course assumes a basic knowledge of linear algebra and calculus. Prior programming experience in Julia, Python, or a similar language is desirable but not required.

Units

4 credits

Course Details

- Lectures: Mondays and Wednesdays, 3:30pm to 4:45pm.
- Recitations: Mondays and Wednesdays, 4:50pm to 5:35pm.
- All times are Europe/Paris time. Daylight Saving Time ends Sunday, 25 October 2026.
- Location: Rooms will be posted in Albert before class.

Course website: nyu-numerical-analysis.github.io/docs

Course Description

This course introduces classical topics in numerical analysis through mathematical derivation, error analysis, and computer implementation. Topics include floating-point arithmetic and round-off error; interpolation, approximation, and numerical quadrature; direct and iterative methods for linear systems; iterative eigenvalue algorithms; numerical methods for nonlinear equations and systems; and numerical integration of ordinary differential equations. Throughout the course, students examine the accuracy, stability, convergence, and computational cost of algorithms and implement methods in Julia. Lectures develop the underlying theory, while recitations combine pen-and-paper analysis with practical computational exercises.

Course Objectives

By the end of the course, students should be able to:

- explain how floating-point representation and round-off affect numerical computation;
- analyze the consistency, stability, convergence, accuracy, and computational complexity of numerical algorithms;
- select and apply appropriate numerical methods for approximation, integration, linear and nonlinear systems, eigenvalue problems, and ordinary differential equations;
- implement numerical algorithms efficiently in Julia and assess their results critically; and

- communicate mathematical reasoning and computational findings clearly.

Assessment Components

You are expected to attend classes in person. Failure to submit or fulfill any required component may result in failure of the class, regardless of grades achieved in other assignments.

- Jupyter notebooks, approximately one per chapter: 25% of the final grade.
- Weekly 15-minute multiple-choice quizzes: 25% of the final grade.
- Final examination component: 50% of the final grade.

The midterm examination is a bonus opportunity for the examination component. If E_{midterm} and E_{final} denote the percentage scores on the midterm and final examinations, respectively, then the examination score is $\max(E_{\text{final}}, 0.4 E_{\text{midterm}} + 0.6 E_{\text{final}})$. The total numerical course score is 0.25 times the notebook score plus 0.25 times the quiz score plus 0.50 times the examination score. The midterm and final include theoretical and practical questions and must be completed without artificial-intelligence tools.

Teaching and Learning Philosophy

Each class combines a theoretical lecture with a recitation comprising mathematical exercises and implementation tasks. Numerical analysis is learned by connecting proofs, algorithms, and experiments; regular preparation and practice are therefore essential. Students are encouraged to ask questions, compare approaches, test claims computationally, and explain not only whether a method works but why and under what assumptions.

Required Texts and Electronic Resources

No textbook purchase is required. Self-contained lecture notes, slides, notebooks, and assignments are provided through the [course website](#) and NYU Brightspace.

Supplemental Texts (not required to purchase)

- Endre Süli and David F. Mayers, *An Introduction to Numerical Analysis*, Cambridge University Press, 2003.
- Alfio Quarteroni, Riccardo Sacco, and Fausto Saleri, *Numerical Mathematics*, second edition, Springer, 2007.

Additional Required Software and Equipment

Students need a laptop capable of running [Julia](#), Jupyter notebooks, and [Visual Studio Code](#) with the Julia extension. All required software is free.

Course Schedule

The schedule below gives the planned sequence. The pace of individual topics may be adjusted to students' preparation and progress, but assessment dates will not change except when required by NYU policy or approved by NYU Paris Academic Affairs. Exact notebook deadlines and the final examination time are posted in NYU Brightspace. Unless otherwise indicated, each meeting includes lecture and recitation components.

Date	Topic	Preparation / Assessment
Wed 2 Sep	Introduction to numerical analysis and Julia	Install Julia and VS Code; review course resources
Mon 7 Sep	Julia functions, arrays, plotting, and numerical workflow	Complete introductory notebook exercises
Wed 9 Sep	Binary representation and IEEE 754 floating-point arithmetic	Weekly quiz
Mon 14 Sep	Round-off error, conditioning, and cancellation	Read Chapter 1 notes
Wed 16 Sep	Stable algorithms and floating-point experiments	Weekly quiz; chapter notebook as posted
Mon 21 Sep	Polynomial interpolation: Lagrange form	Read Chapter 2 notes
Wed 23 Sep	Newton interpolation and divided differences	Weekly quiz
Mon 28 Sep	Interpolation error and Chebyshev points	Interpolation exercises
Wed 30 Sep	Piecewise interpolation, splines, and approximation	Weekly quiz; chapter notebook as posted
Mon 5 Oct	Interpolatory quadrature and Newton-Cotes rules	Read numerical integration notes
Wed 7 Oct	Composite quadrature and error analysis	Weekly quiz
Mon 12 Oct	Gaussian quadrature and practical integration	Integration exercises
Wed 14 Oct	Adaptive ideas, implementation, and synthesis	Weekly quiz; chapter notebook as posted
Fri 16 Oct	Make-up day: integration and midterm preparation	Make-up class; attendance required
Mon 19 Oct	Midterm review and computational practice	Review Chapters 0-2
Wed 21 Oct	Direct linear solvers: elimination, LU, pivoting, conditioning, and Cholesky	Weekly quiz; read Chapter 3 notes
Mon 26 Oct	Fall Break - No Class	
Wed 28 Oct	Fall Break - No Class	
Mon 2 Nov	Direct linear solvers: computational practice and midterm review	Linear systems exercises; review Chapters 0-2
Wed 4 Nov	Midterm examination	Theoretical and practical questions; no AI tools
Mon 9 Nov	Stationary iteration: Jacobi, Gauss-Seidel, SOR, and convergence	Chapter notebook as posted
Wed 11 Nov	Public Holiday - No Class	
Mon 16 Nov	Eigenvalue problems: power and inverse iteration	Read Chapter 4 notes
Wed 18 Nov	QR iteration and PageRank	Weekly quiz; chapter notebook as posted
Mon 23 Nov	Scalar nonlinear equations and fixed-point iteration	Read Chapter 5 notes

Wed 25 Nov	Newton methods for nonlinear systems	Weekly quiz
Mon 30 Nov	Convergence and implementation of nonlinear solvers	Chapter notebook as posted
Wed 2 Dec	Ordinary differential equations: Euler and Runge-Kutta methods	Weekly quiz; read Chapter 6 notes
Mon 7 Dec	Stability, convergence, and implementation for ODEs	ODE exercises; chapter notebook as posted
Wed 9 Dec	Make-up day: course synthesis and final-exam preparation	Make-up class; attendance required

Final examination: during the NYU Paris final examination period, at the time assigned by NYU Paris. Final examinations may not be taken early or late.

Classroom Expectations

To optimize the learning environment:

- Please do not eat during class and minimize distracting noise or unnecessary departures before the break.
- Cell phones should be turned off or placed in silent mode unless they are being used for the lesson.
- Allow classmates to finish speaking before responding.
- Be respectful and courteous to all class participants.
- Arrive on time and do not depart early.
- Use laptops for course-related mathematical and computational work during class.

Your Lecturer

Urbain Vaes is a researcher at Inria, the French national research institute for computer science and applied mathematics. His research focuses on the analysis and development of computational methods for sampling high-dimensional probability measures, particularly for applications in computational statistical physics and Bayesian inference.

Academic Policies

Grading Scheme

For this course, the total numerical score calculated from the components listed above corresponds to the following letter grades without rounding:

US Letter Grade	US Numerical	French Numerical	Description
A	94 to 100	15-20	Excellent
A-	90 to < 94	14	Very good
B+	87 to < 90	13	Good
B	84 to < 87	12	Good
B-	80 to < 84	11	Satisfactory
C+	77 to < 80	10	Sufficient
C	74 to < 77	9	Sufficient
C-	70 to < 74	8	Sufficient
D+	67 to < 70	7	Poor
D	65 to < 67	5-6	Poor
F	0 to < 65	1-4	Fail

Site policy does not allow grading of work outside the assignments included in this syllabus. The final grade will be calculated only from the assessment components listed above; no additional or substituted work is permitted.

Attendance Policy

Studying at Global Academic Centers is an academically intensive and immersive experience, in which students from a wide range of backgrounds exchange ideas in discussion-based seminars. Learning in such an environment depends on the active participation of all students. Since classes typically meet once or twice a week, even a single absence can cause a student to miss a significant portion of a course. To ensure the integrity of this academic experience, class attendance at the centers, or online through NYU Brightspace if the course is remote synchronous/blended, is expected promptly when class begins.

Attendance will be checked at each class meeting. If you have scheduled a remote course immediately preceding or following an in-person class, you may write to nyu.paris.academics@nyu.edu to ask whether you can take your remote class at the Academic Center.

As soon as it becomes clear that you cannot attend a class, you must inform your professor and follow the study away site's procedures for reporting an absence immediately, before the start of class. Absences are excused only when due to illness, Moses Center accommodations, religious observance, or emergencies. Site staff may ask you to present a doctor's note or exceptional permission from an NYU staff member as proof. Emergencies or other exceptional circumstances that you wish to be treated confidentially must be presented to staff.

Unexcused absences may be penalized with a two percent deduction from the student's final participation grade for every week's worth of classes missed, and may negatively affect your final grade. Accumulated absences in one course may lead to an F (Fail) in that course. Being more than 15 minutes late counts as an unexcused absence. Furthermore, your professor may deduct points for frequently joining the class late.

Exams, tests, quizzes, deadlines, and presentations missed due to illness may require a doctor's note as documentation. It is the student's responsibility to produce this doctor's note and submit it to site staff; until the note is produced, the missed assessment is graded with an F and no make-up assessment is permitted.

Exams, tests, quizzes, deadlines, and presentations missed for any other reason may or may not be made up at the discretion of the instructor in consultation with site staff and the Office of Global Programs. Regardless of whether an absence is excused, it is the student's responsibility to catch up with missed work.

Final Exams

Final exams must be taken at their designated times. If there is a conflict between final exams, students must bring it to the attention of the Academics team. Final exams may not be taken early or late, and students should not plan to leave the site before the end of the finals period.

Late Submission of Work

- (1) Work submitted late may be declined or may receive a penalty for each day it is late, including weekends and public holidays.
- (2) Students may request extensions, which may or may not be approved at the discretion of the instructor in consultation with site staff and the Office of Global Programs.
- (3) Without an approved extension, written work submitted more than 5 days after the submission deadline, including weekends and public holidays, may receive an F.
- (4) Assignments due during finals week that are submitted more than 3 days late, including weekends and public holidays, without a previously arranged extension may not be accepted and may receive a zero. Exceptions or extensions are at the discretion of the instructor in consultation with site staff and the Office of Global Programs.
- (5) Students who miss any part of a timed assignment or exam may or may not receive an extension or opportunity to make up missed work. Exceptions or extensions are at the discretion of the instructor in consultation with site staff and the Office of Global Programs.

Incompletes

An incomplete is a temporary grade indicating that a student has, for good reason, not completed all course work. This grade is not awarded automatically or guaranteed. Incompletes are at the discretion of the instructor in consultation with site staff and the Office of Global Programs.

Academic Honesty and Plagiarism

As the University's policy on Academic Integrity for Students at NYU states: At NYU, a commitment to excellence, fairness, honesty, and respect within and outside the classroom is essential to maintaining the integrity of our community. By accepting membership in this community, students take responsibility for demonstrating these values in their own conduct and for recognizing and supporting these values in others. Students at Global Academic Centers must follow University and school policies.

NYU takes plagiarism very seriously; penalties follow and may exceed those set by a student's home school. The lecturer may ask students to sign a declaration of authorship and may check assignments using Turnitin or other software designed to detect academic-integrity offenses.

The presentation of any improperly cited work other than your own as though it is your own, including words, ideas, judgment, images, data, or AI-generated work such as output from ChatGPT or Google Gemini, whether intentionally or unintentionally, constitutes a breach of academic integrity. All work submitted for this course must be your own. It is also an offense to submit your own work for assignments from two different courses that are substantially the same. If an assignment overlaps with work produced for another course in the current or a previous semester, you must inform your professor.

For guidelines, examples, procedures, sanctions, and citation resources, see the [NYU Academic Integrity Policies and Guidelines](#) and [NYU Library Guides](#).



Inclusivity Policies and Priorities

NYU's Office of Global Programs and NYU's global sites are committed to equity, diversity, and inclusion. To nurture a more inclusive global university, NYU affirms the value of sharing differing perspectives and encourages open dialogue through a variety of pedagogical approaches. The goal is to make all students feel included and welcome in all aspects of academic life, including syllabi, classrooms, and educational activities and spaces.

Attendance Rules on Religious Holidays

NYU's Calendar Policy on Religious Holidays states that members of any religious group may, without penalty, excuse themselves from classes when required by their religious obligations. Students must check for conflicts at the beginning of the semester and notify the lecturer and NYU Paris Academics Office in writing by email at least one week before an anticipated absence. If an exam or assignment deadline falls on that day, the Academics Office will facilitate an alternative. The holiday absence is excused, but travel days before or after it are not.

Pronouns and Name Pronunciation (Albert and Zoom)

Students, staff, and faculty may add their pronouns and the pronunciation of their names in Albert and control where this information is displayed. For instructions, see the Pronouns and Name Pronunciation website. Students, staff, and faculty are also encouraged, though not required, to list their pronouns and update their display names in Zoom; see the Personalizing Zoom Display Names website.

Moses Accommodations Statement

Academic accommodations are available for students with documented and registered disabilities. Please contact the Moses Center for Student Accessibility and Inclusive Culture (+1 212-998-4980 or mosescsd@nyu.edu) for further information. Students requesting academic accommodations are advised to contact the Moses Center as early as possible in the semester. Retroactive accommodations are not permitted in accordance with Moses Center policies. Accommodations for this course are managed through NYU Paris.

Bias Response

The New York University Bias Response Line provides a mechanism through which community members can share or report experiences and concerns involving bias, discrimination, or harassing behavior. Administrators in the Office of Equal Opportunity receive and assess reports and facilitate responses, which may include referral to another University school or unit or an investigation under the University's Non-Discrimination and Anti-Harassment Policy.

To report an incident:

- Online using the Bias Response web form: https://nyu.qualtrics.com/jfe/form/SV_55x3HRqPYDsI0uN
- Email: bias.response@nyu.edu
- Phone (New York): +1 212-998-2277
- Local phone (Paris): +33 (0)1 53 73 29 77

Wellness and Counseling Resources

Mental-health resources are available to students studying at NYU Paris through NYU's Wellness Exchange. Students may call the Paris 24-hour hotline at +33 6 83 75 16 10; chat through the Wellness Exchange app for iPhone or Android; call +1 212-443-9999 to arrange a same-day urgent counseling session; or email wellness.exchange@nyu.edu during business hours. Students may also contact NYU Paris's onsite Global Wellness Counselor at paris.counseling@nyu.edu.