SYRACUSE UNIVERSITY, SUMMER 2025 SYLLABUS

MAT 532, Applied Linear Algebra

Key changes to the course structure *due to summer session and asynchronous lecture format* are provided here at the top. The rest of the syllabus provides the usual policies.

- Since this is an online course, students MUST have the associated technologies:
  - **a reliable internet connection, a fairly new laptop/desktop/Mac, a webcam, a cellphone, and a scanner app (such as Adobe Scan, etc.) or a scanning device.**
- Lectures will be done online.
  - The videos will be posted on Blackboard. Supplementary videos might be posted with additional details/examples.
  - Students must watch the recording asynchronously within 36 hours from posting the lecture.
- Attendance Assessments:
  - Blackboard is able to track the access. The attendance will be counted based on this.
- The assessments will be spread through the summer session
  - Keeping up with the course on a regular basis will be very important.
  - This includes regularly watching the lecture (videos), accessing the course Blackboard page regularly, and completing any work (HW and/or Quiz) assigned after each lecture.
- The exams will be proctored via video conference (Zoom or Google Meet). Logistics will be announced as the semester gets going.
  - **Exams must be considered similar to an in-class closed book exam. No other resources must be around. You will be asked to show your room/table etc. You may be asked to point your camera to any point in your room anytime. You must share your screen during the whole exam and your video must always be on. Screen savers and background pictures are not allowed. If disconnected for more than a couple of minutes or disconnected several times during the exam, the exam will be considered invalid.**

General Information

Course: MAT 532 (Class Number: 72348; Course ID: 006273)
ONLINE ASYNCHRONOUS; Dates: Monday May 19 to Friday June 06/27/2025
Instructor: Thomas John, Ph.D., Carnegie-313D, email: thjohn@syr.edu,
Office Hours (Virtual): Mon thru Thu 10 AM – 11 AM. Links will be posted on Blackboard.

Course Catalogue Description:

Factorization of matrices, eigenvalues and eigenvectors, orthogonality. Applications of matrices to such topics as least-squares approximation, fast Fourier transform, difference and differential equations, linear programming, networks, game theory.
Prereq: MAT 331 or 485 or graduate standing in mathematical sciences

Course/Topics Overview:

(1) Linear equations: Gaussian elimination, Gauss-Jordan method, applications to boundary value problems, floating point arithmetic, ill-conditioned matrices.
(2) Rectangular systems and echelon forms: (reduced) row echelon form, rank, consistency of linear systems, homogeneity, applications to electrical circuits.
(3) Matrix algebra: brief review of multiplication and inverses, sensitivity of inverses, elementary matrices, LU factorization
(4) Vector spaces: linear independence, basis, dimension, least squares
(5) Norms and inner products: orthogonality, Gram-Schmidt, QR factorization, orthogonal matrices, singular value decomposition

Text:

- *Applied Linear Algebra (2nd ed. 2018.).* Olver, P. J., & Shakiban, C.
  - Springer International Publishing. https://doi.org/10.1007/978-3-319-91041-3
  - https://search.syr.edu/permalink/01SYU_INST/16ashv9/alma9972320975308496

Additional Reference:

- *Applied Linear Algebra and Matrix Analysis (2nd ed. 2018.).* Shores, T. S.
  - Springer International Publishing. https://doi.org/10.1007/978-3-319-74748-4
  - https://search.syr.edu/permalink/01SYU_INST/16ashv9/alma9972320954908496

The search.syr.edu links above (via EZproxy login) give full access to the free electronic textbooks above.

Links to additional resources will be announced and provided on the course blackboard page.

Exam Dates:

- Midterm Exam: Friday, June 6th
- **CUMULATIVE FINAL EXAM:** Friday, June 27th

Special Note on the Final Exam:

All students must take the cumulative final exam at their scheduled time.
There will be no exceptions.

Grading:

Your final grade will be based on a midterm exam (25%), a cumulative final exam (30%), projects (20%), HW/ Quizzes / class engagement (25% = 10% + 10% + 5%). Final letter grades will be given according to the following scale:

A (93-100); A- (90-92); B+ (87-89); B (83-86); B- (80-82);
C+ (77-79); C (73-76); C- (70-72); D (60-70); F (0-59)

(No) Makeup Policy:

There will be absolutely no make-ups for any reason. If you miss a quiz/test for a valid reason (which must be verified by a documentation from a physician or from SOaR (Student Outreach and Retention) see https://experience.syracuse.edu/soar/student-support/absence-notifications/), performance from the corresponding part of a test/final will be used as replacement.

Homework:

Homework will be assigned regularly and some of the problems may be asked to be turned in. You may discuss these problems with other students, but each of you is expected to write up your own solutions independently. The ***best*** way to learn this material is to do homework problems. Try as much as possible to do the homework on your own.

No Extensions on Submission Deadlines:

No extension will be given in any circumstances. If you have a valid excuse, you may be exempted from that assignment, *as long as your excuse covers the entire assignment period- not just the due date only*. Do not wait until the due date to do your assignment. "Internet problems," "Broken laptops," "homework portal down on due date," etc. are not valid excuses.

This policy is in place also from the perspective of professional responsibilities. A professional almost often works under expectations and deadlines (from a team, a client, brand competition, delivery opportunity, regulatory, etc.) and these deadlines are almost always unmovable.

Shared Competencies:

MAT 532 supports the following among the Syracuse University's Shared Competencies:

- Scientific Inquiry and Research Skills

Attendance:

You are expected to attend every class and every exam. If you miss a class, it is your responsibility to obtain a copy of the lecture notes for that class from another student. You are also responsible for any announcements about changes to the course schedule, the exam schedule, or the course requirements that were made during that class.

It is a federal requirement that faculty promptly notify the university of students who do not attend or cease to attend any class. Faculty will use Early-Semester Progress Reports and Mid-Semester Progress Reports in Orange SUccess to alert the Registrar and Financial Aid Office on non-attendance.

Computational Software:

Students are expected to learn to use a computing software for the purposes of the dealing with the "applied" portion of linear algebra. During the regular semesters, MATLAB is the software used and it is a reasonable policy because students can access it on the cluster computers. For the summer course, at least a few students will not be on/close to campus. R is open source, very reputable software, and can do all of the numerical linear algebra we need to do. Learning to use R (beginner level) is a good skill on its own. Further, the syntax of R and MATLAB are very similar[1]. I will be using R for illustration in this course. Students are expected to learn to use it by building on from the illustrations in lectures and going further on their own using the rich resources available on the internet.

University Policies

Email Policy:

Syracuse University has established email as a primary vehicle for official communication with students, faculty, and staff. An official email address is established and assigned by Information Technology Services (ITS) for each registered student, as well as for all active faculty and staff members. All University communications sent via email will be sent to this address. Faculty and staff members must use the officially established University email address to communicate with students registered in their classes. Keep in mind that student records sent to a non-syr.edu email address may create a FERPA violation (See the complete policy at Syracuse University Email Policy).

Use of Class Materials and Recordings:

Original class materials (handouts, assignments, tests, etc.) and recordings of class sessions are the intellectual property of the course instructor. You may download these materials for your use in this class. ***However, you SHALL NOT provide these materials to other parties (e.g., web sites, social media, and other students). Doing so is a violation of intellectual property law and of the student code of conduct.***

Students with disabilities:

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to contact me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Center for Disability Resources (CDR) in this process.

If you would like to discuss disability-accommodations or register with CDR, please visit their website (https://disabilityresources.syr.edu). Please call (315) 443-4498 or email disabilityresources@syr.edu for more detailed information. The CDR is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact CDR as soon as possible to begin this process.

[1] https://www.mathworks.com/discovery/matlab-vs-r.html

Academic Integrity:

As a pre-eminent and inclusive student-focused research institution, Syracuse University considers academic integrity at the forefront of learning, serving as a core value and guiding pillar of education. Syracuse University's Academic Integrity Policy provides students with the necessary guidelines to complete academic work with integrity throughout their studies. Students are required to uphold both course-specific and university-wide academic integrity expectations such as crediting your sources, doing your own work, communicating honestly, and supporting academic integrity. The full Syracuse University Academic Integrity Policy can be found by visiting class.syr.edu, selecting, "Academic Integrity," and "Expectations and Policy."

Upholding Academic Integrity includes the protection of faculty's intellectual property. Students should not upload, distribute, or share instructors' course materials, including presentations, assignments, exams, or other evaluative materials without permission. Using websites that charge fees or require uploading of course material (e.g., Chegg, Course Hero) to obtain exam solutions or assignments completed by others, which are then presented as your own violates academic integrity expectations in this course and may be classified as a Level 3 violation. All academic integrity expectations that apply to in-person assignments, quizzes, and exams also apply online.

Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered. Students may not drop or withdraw from courses in which they face a suspected violation. Any established violation in this course may result in course failure regardless of violation level.

Artificial Intelligence:

Based on the specific learning outcomes and assignments in this course, artificial intelligence is permitted on certain assignments. See each assignment, quiz, or exam instructions for more information about what artificial intelligence tools are permitted and to what extent, as well as citation requirements. If no instructions are provided for a specific assignment, then no use of any artificial intelligence tool is permitted. Any AI use beyond that which is detailed in course assignments is explicitly prohibited except when documented permission is granted.

Religious observances policy:

Syracuse University's Religious Observances Policy recognizes the diversity of faiths represented in the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their traditions. Under the policy, students are given an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify their instructors no later than the academic drop deadline. For observances occurring before the drop deadline, notification is required at least two academic days in advance. Students may enter their observances in MySlice under Student Services/Enrollment/My Religious Observances/Add a Notification.

Learning Objectives:

After completing this course, a student should be able to

- Solve systems of linear equations using Gaussian elimination with back substitution and Gauss-Jordan elimination.
- Analyze algorithms for solving linear systems and understand error due to rounding and floating-point arithmetic and the implications for the conditioning of the linear system.
- Construct linear models for a variety of applied problems.
- Compute solutions to linear systems accurately and efficiently by hand and with the aid of software when appropriate.
- Understand and use ideas of linear independence, basis, and dimension in vector spaces to draw conclusions about applied problems in linear algebra.
- Understand and compute factorizations and decompositions that aid in the computation of solutions to linear systems (LU factorization, QR factorization, singular value decomposition)