MATH 355, Advanced Linear Algebra

Syllabus, Spring 2026

Course Information.

- 4 semester hours
- Professor: Thomas Scofield
- Text: *Applied Linear Algebra and Matrix Methods* (Springer, 2023), by Timothy G. Feeman.

Catalog Description.
Vector spaces, linear transformations, eigenvalues and eigenvectors, inner product spaces, spectral theory, singular values and pseudoinverses, canonical forms, and applications.

Student Learning Outcomes. Upon successful completion of this course, students will

- know the basic definitions and ideas associated with abstract vector spaces.
- know the theory and practice of matrix representations for linear transformations.
- know the special characteristics of an inner product space; in particular, they will be able to conduct the Gram-Schmidt orthogonalization process, and to find least-squares solutions to linear ill-posed problems.
- understand the interplay between eigenvalues, diagonalization, and the singular value decomposition of a matrix, and demonstrate an ability to find/use them.
- use relevant concepts to solve applied problems.

Topics include

1. Vector spaces and subspaces
2. Bases of vector spaces and subspaces
3. Linear transformations
4. Matrix representations of linear transformations with respect to given bases
5. Eigenvalues and eigenvectors of linear operators
6. Inner product spaces
7. Orthogonal bases
8. Self-adjoint operators and the Spectral Theorem
9. The Singular Value Decomposition
10. Special matrices (such as triangular, self-adjoint, orthogonal, and Jordan matrices)

Methods of Evaluation.

Assessment	Pct
Homework assignments	22%
Midterm tests (Feb. 25, and Apr. 17)	44%
Final (May 5, at 9 am)	34%

Policies.

- You are expected to attend class faithfully, in person. When you cannot, regardless of reason, you are responsible for catching yourself up.
- Before class begins, visit the restroom, and prepare yourself for a prompt beginning. This includes packing away your electronic devices.
- If written work is assigned, you are to submit only work which is done by you. You **may** collaborate with other students, but after you have hashed out ideas, those must be written up in isolation using your words. **You are not to use AI tools to produce (any) evaluated work attributed to you.** Violations of this policy shall result in a score of zero. Repeated instances shall result in a course grade of "F".
- Course administration (communication, assignments, scores, etc.) is conducted in MyOpenMath. The calendar is something you should check regularly for assignments, daily readings and learning objectives, and anything else deemed useful.
- Homework is submitted in MyOpenMath and, most often, auto-checked and scored right away. Each assignment has its own deadline, and it is up to you to stay on top of the schedule. If you should miss a deadline, you have a bank of 5 late passes that, when used, extend a deadline 24 hours. **You may not use more than one late pass per assignment.** Be a good steward of your late passes as, almost certainly, there will be times when circumstances beyond your control are the cause of lateness.
- All in-class evaluations in the course are calculator-free. Use of Octave/Matlab is necessary for some out-of-class assignments, and is encouraged for these as appropriate.
- You are expected to take exams on the dates specified, or provide sufficient cause why you cannot. Family trips, pre-arranged flights, etc. are *not* sufficient cause. Neither extra credit, nor make-up exams/homeworks are allowed, under normal circumstances.

Disabilities and/or sickness. Special circumstances may require, occasionally, a policy adjustment for a particular student. In such cases, it is the responsibility of the student to inform me of the situation as soon as possible, so that appropriate arrangements can be made. This includes, but is not limited to, students with documented disabilities. Calvin University is committed to providing reasonable accommodations for students with documented disabilities. Students with disabilities requiring special assistance to facilitate participation in this class are urged to contact Disability Services in the Center for Student Success (`disabilityservices@calvin.edu`) as soon as possible to explore arrangements.

Policy review. I reserve the right to make changes or exceptions to course policies, including those described in this document, either for the entire class or for individuals. The ultimate goal in this course is **learning**, and formal requirements should not unnecessarily stand in the way of that. Thus, if you think that any of the conditions of the course are interfering with learning, please speak with me about this, and we will consider what can be done.