湖北工業大學
HUBEI UNIVERSITY OF TECHNOLOGY

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| **Course Title** | Linear Algebra I |
| **Course Code** | MATH 2151 |
| **Semester** | Spring 2026 |
| **Course Length** | 4 Weeks, 60 Contact Hours |
| **Credits** | 4 |
| **Instructor** | TBA |
| **Office** | TBA |
| **Email** | TBA |
| **Prerequisite** | N/A |

**Course Description:**

This course provides students with mathematical material in Linear Algebra foundational for mathematics, engineering and the sciences. Topics include systems of linear equations, matrix algebra and operations, vector spaces and subspaces, linear transformations, eigenvalues and eigenvectors, inner product spaces, orthogonality, and computational methods using software tools.

**Course Goals:**

Students who successfully complete this course will demonstrate competency in the following general education core goals:

- **Critical thinking skills** – Students will engage in creative and/or innovative thinking, and/or inquiry, analysis, evaluation, synthesis of information, organizing concepts, and constructing solutions.
- **Communication skills** – Students will demonstrate effective written, oral, and visual communication.
- **Teamwork** – Students will demonstrate the ability to work effectively with others to support a shared purpose or goal and consider different points of view.
- **Social responsibility** – Students will demonstrate intercultural competency and civic knowledge by engaging effectively in local, regional, national, and global communities.

**Student Learning Outcomes:**

Upon completion of this course, students will be able to:

- employ techniques to classify and solve linear systems of equations;
- illustrate the use of matrices and determinants;
- utilize vector spaces and linear transformations;
- compute eigenvalues and eigenvectors of matrices;

- understand the geometry of inner product spaces: dot product, orthogonality, projections, orthonormal bases, Gram-Schmidt process, and least squares approximations;
- Use computational software (e.g., MATLAB, Python) to perform matrix operations, solve linear systems, compute eigenvalues, and implement algorithms such as Gram-Schmidt and least squares;
- apply linear algebraic concepts in selected applications (e.g., to geometry, differential equations, Markov chains or economic models) as time permits.

**Textbooks/Supplies/Materials/Equipment/ Technology or Technical Requirements**:

TEXTBOOK: David C. Lay, Judi J. McDonald, and Steven R. Lay, *Linear Algebra and Its Applications, 6th Edition (2021).*

TECHNOLOGY: Students must have access to a computer with MATLAB, Python (NumPy/SciPy), or similar software.

**Course Requirements**:

**Homework**
Homework assignments are central to mastering linear algebra. Students will complete problem sets combining routine computations and short proofs. Problem sets reinforce conceptual understanding, accuracy, and fluency with matrices, vector operations, and proofs.

**Quizzes**
Short quizzes or in-class problem checks will periodically assess immediate understanding of recently covered material. These are designed to encourage consistent study habits and to provide early feedback before major exams.

**Lab Reports**
There will be 4-5 labs throughout the course. The lab report assessment requires students to submit a formal written report along with the corresponding computational code. Requirements include the use of proper mathematical notation, well-documented and organized code, accurate execution of algorithms, and a coherent discussion that connects computational outcomes to theoretical principles covered in the course. Lab topics may include:

- Solving linear systems using Gaussian elimination and matrix factorization
- Implementing the Gram-Schmidt process and QR decomposition
- Computing eigenvalues and eigenvectors for diagonalization
- Applying least squares regression to real-world datasets
- Modeling and analyzing Markov chains using matrix powers
- Exploring image transformations using linear operators and SVD

**Midterm Exams**
Two midterms divide the course into natural conceptual blocks: (1) linear systems & matrix algebra, and (2) vector spaces & determinants. They help students integrate ideas and identify areas needing reinforcement.

**Final Exam**

The final exam is comprehensive, testing both computational proficiency and conceptual understanding across all units. It typically includes multi-step proofs, matrix computations, and applied modeling problems that draw connections among topics learned throughout the semester.

| **Assessments: Activity** | **Percent Contribution** |
|---|---|
| Homework | 15% |
| Quizzes | 10% |
| Lab Reports | 15% |
| Midterm Exams (2) | 30%, 15% each |
| Final Exam | 30% |

**Grading:**

Final grades will be based on the sum of all possible course points as noted above.

| **Grade** | **Percentage of available points** |
|---|---|
| A | 94-100 |
| A- | 90-93 |
| B+ | 87-89 |
| B | 84-86 |
| B- | 80-83 |
| C+ | 77-79 |
| C | 74-76 |
| C- | 70-73 |
| D | 64-69 |
| D- | 60-63 |
| F | 0-59 |

**Course Schedule**:

*The schedule of activities is subject to change at the reasonable discretion of the instructor. Minor changes will be announced in class, major ones provided in writing.*

| **MATH 2151 Schedule** | | |
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| Lecture | Topic | Readings |
| L1 | Introduction to Linear Models; overview of systems of linear equations | Ch. 1 |
| L2 | Row reduction and echelon forms; Gaussian elimination | Ch. 1 |
| L3 | Vector equations and geometric interpretation | Ch. 1 |
| L4 | The matrix equation Ax = b | Ch. 1 |
| L5 | Solution sets of linear systems; homogeneous systems | Ch. 1 |
| L6 | Applications of linear systems; linear independence | Ch. 1 |
| L7 | Introduction to linear transformations; matrix of a linear transformation | Ch. 1 |
| L8 | Review and applied modeling (linear models in business, science) | Ch. 1 +review |
| L9 | Matrix operations and properties of matrix multiplication | Ch. 2 |
| L10 | Matrix inverses; equivalent conditions for invertibility | Ch. 2 |
| L11 | Partitioned matrices and basic factorizations; applications | Ch. 2 |
| L12 | Subspaces of $\mathbb{R}^n$, dimension, and rank | Ch. 2 |
| L13 | Determinants introduction | Ch. 3 |
| / | **Midterm 1** | Ch. 1-2 |

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| L14 | Properties of determinants; computation and cofactor expansion | Ch. 3 |
| L15 | Cramer's Rule, volume interpretation, and linear transformations | Ch. 3 |
| L16 | Vector spaces and subspaces; nullspace, column space | Ch. 4 |
| L17 | Linearly independent sets, bases, coordinate systems | Ch. 4 |
| L18 | Dimension, change of basis, and applications (signal processing) | Ch. 4 |
| L19 | Eigenvalues and eigenvectors; characteristic equation | Ch. 5 |
| / | **Midterm 2** | Ch. 3-4 |
| L20 | Diagonalization; eigenvectors and linear transformations | Ch. 5 |
| L21 | Complex eigenvalues and discrete dynamical systems | Ch. 5 |
| L22 | Orthogonality, inner product, and orthogonal sets | Ch. 6 |
| L23 | Orthogonal projections; Gram-Schmidt; least squares | Ch. 6 |
| L24 | Machine learning and inner product spaces; symmetric matrices | Ch. 6-7 |
| L25 | Review and applications (optimization, image processing) | Ch. 7 + review |
| / | **Final Exam** | / |

## Accommodation Statement

Academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he/she is not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow.

## Academic Integrity Statement

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in coursework may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

## Other Items:

### Attendance and Expectations

All students are required to attend every class, except in cases of illness, serious family concerns, or other major problems. We expect that students will arrive on time, be prepared to listen and participate as appropriate, and stay for the duration of a meeting rather than drift in or out casually. In short, we anticipate that students will show professors and fellow students maximum consideration by minimizing the disturbances that cause interruptions in the learning process. This means that punctuality is a must, that cellular phones be turned off, and that courtesy is the guiding principle in all exchanges among students and faculty. You will be responsible for the materials and ideas presented in the lecture.

**Assignment Due Dates**
All written assignments must be turned in at the time specified. Late assignments will not be accepted unless prior information has been obtained from the instructor. If you believe you have extenuating circumstances, please contact the instructor as soon as possible.

**Make-Up Work**
The instructor will not provide students with class information or make-up assignments/quizzes/exams missed due to an unexcused absence. Absences will be excused and assignments/quizzes/exams may be made up only with written documentation of an authorized absence. Every effort should be made to avoid scheduling appointments during class. An excused student is responsible for requesting any missed information from the instructor and setting up any necessary appointments outside of class.

**Access, Special Needs and Disabilities**
Please notify the instructor at the start of the semester if you have any documented disabilities, a medical issue, or any special circumstances that require attention, and the school will be happy to assist.