NEW YORK CITY COLLEGE OF TECHNOLOGY
The City University of New York

DEPARTMENT: Mathematics

COURSE: MAT 2580

TITLE: Introduction to Linear Algebra

DESCRIPTION: An introductory course in Linear Algebra. Topics include vectors, vector spaces, systems of linear equations, linear transformations, properties of matrices, determinants, eigenvalues, and eigenvec-tors.

TEXT: Linear Algebra by Kuttler
https://math.libretexts.org/Bookshelves/Linear_Algebra/A_First_Course_in_Linear_Algebra_(Kuttler)

CREDITS: 3 (3 class hours)

PREREQUISITES: MAT 1475 (Calculus I)

Prepared by Professors Africk and Parker, Spring 2024.

TESTING GUIDELINES: The following exams should be scheduled:

1. A one session exam at the end of the First Quarter.
2. A one session exam at the end of the Second Quarter.
3. A one session exam at the end of the Third Quarter.
4. A one session Final Examination.

Course-Based Learning Outcomes and Alignment with General Education Goals

Upon satisfactory completion of this course, the student will be able to:

Course Learning Outcomes	**General Education Learning Outcomes**	**Flexible Core - Scientific World**
Be able to solve systems of linear equations using Gaussian Elimination	Understand and employ both quantitative and qualitative reasoning to solve problems	Gather, interpret, and assess information from a variety of sources
Be able to analyze and interpret the solutions of linear systems	Employ scientific reasoning and logical thinking	Produce well-reasoned written arguments using evidence to support conclusion
Be able to identify and apply vector properties and matrix properties to solve matrix and vector equations	Understand and employ both quantitative and qualitative reasoning to solve problems	Identify and apply fundamental concepts and methods of mathematics to explore the scientific world
Be able to use matrices to solve linear systems and interpret their solutions	Adapt and apply theories gained in one situation to another situation	Demonstrate how tools of mathematics can be used to analyze problems and develop solutions
Be able to identify and apply the properties of vector spaces and subspaces to classify sets of vectors	Communicate effectively using written and oral means	Produce well-reasoned written arguments using evidence to support conclusion
Be able to analyze linear transformations and their associated vector spaces using properties of matrices and linear systems	Adapt and apply theories gained in one situation to another situation	Evaluate evidence and arguments critically or analytically
Be able to identify eigenvalues and eigenvectors of a matrix to diagonalize a matrix		Identify and apply fundamental concepts and methods of mathematics to explore the scientific world
Be able to use technology to assist with computations	Utilize technology in accessing information, solving problems, and communicating	Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world

New York City College of Technology Policy on Academic Integrity

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. The complete text of the College policy on Academic Integrity may be found in the catalog.

MAT 2580 - Introduction to Linear Algebra
Course Outline

Textbook: Linear Algebra by Kuttler (https://www.lyryx.com/first-course-linear-algebra/)

Class	Lesson	Section	Pages	Homework
1	Systems of Equations, Algebraic Procedures (Gaussian Elimination)	1.2	pp. 8–18	1.2.1–1.2.9 WW: Systems of Linear Equations WW: Gaussian Elimination
2	Systems of Equations, Algebraic Procedures (continued)	1.2	pp. 18–27	1.2.10–1.2.15 WW: Gaussian Elimination (cont)
3	Matrix Addition and Scalar Multiplication Matrix Multiplication The Transpose	2.1 2.2 2.3	pp. 49–71	2.1.1, 2.1.2 2.2.1 2.3.1–2.3.4 WW: Matrix Operations
4	The Identity Matrix and Matrix Inverses Finding the Inverse of a Matrix	2.4 2.5	pp. 72–79	2.5.1–2.5.8 WW: The Inverse of a Matrix
5	Finding the Inverse of a Matrix (continued)	2.5	pp. 79–82	2.5.9–2.5.10 WW: Characterizations of Invertible Matrices
6	Elementary Matrices	2.6	pp. 82–92	2.6.1–2.6.7 WW: Elementary Matrices
7	Basic Techniques and Properties of Determinants	3.1	pp. 109–121	3.1.1–3.1.3 WW: Introduction to Determinants
8	Basic Techniques and Properties of Determinants (continued)	3.1	pp. 122–124	3.1.4–3.1.7 WW: Properties of Determinants
9	**Exam 1** (Lessons 1–7)			
10	Applications of the Determinant (Cramer's Rule)	3.2	pp. 136–139	3.2.1 –3.2.4 WW: Cramer's Rule
11	Vectors in $\mathbb{R}^n$, Length of a Vector	4.1–4.2 4.3	pp. 143–161	4.2.1–4.2.4 4.3.1–4.3.4 WW: Vectors in Space WW: Norm and Distance
12	Dot Product, Projections	4.4	pp. 161–171	4.4.1–4.4.6 WW: Dot Product WW: Projections
13	Cross Product	4.5	pp. 171–176	4.5.1–4.5.5 WW: Cross Product

Class	Lesson	Section	Pages	Homework
14	Parametric Lines Planes in $\mathbb{R}^n$	4.6 4.7	pp. 180–185 pp. 187–192	4.6.1–4.6.9 WW: Parametric Lines 4.7.1–4.7.4 WW: Planes in $\mathbb{R}^n$
15	Spanning and Linear Independence in $\mathbb{R}^n$	4.8	pp. 195–197	4.8.1–4.8.3 WW: Spanning Sets
16	Spanning and Linear Independence in $\mathbb{R}^n$ (continued)	4.8	pp. 195–197	4.8.4–4.8.6 WW: Linear Independence
17	Review			
18	**Midterm** (Lessons 1-16)			
19	Subspaces, Basis and Dimension	4.9	pp. 206–217	4.9.1–4.9.6 WW: Subspaces of $\mathbb{R}^n$ WW: Coordinates and Basis
20	Row Space, Column Space and Null Space of a Matrix	4.10	pp. 218–226	4.10.1–4.10.6 WW: Row Column and Null Spaces
21	Orthogonal and Orthonormal Sets and Matrices	4.11	pp. 227–235	4.11.1–4.11.7 WW: Orthogonal Sets
22	Linear Transformations	5.1	pp. 261–265	5.1.1 WW: Introduction to Linear Transformations
23	Eigenvalues and Eigenvectors of a Matrix	7.1	pp. 339–352	7.1.1–7.1.4 WW: Eigenvectors and Eigenvalues WW: The Characteristic Equation
24	Diagonalization	7.2	pp. 353–359	7.2.1–7.2.4 WW: Diagonalization
25	**Exam 3** (Lessons 19–23)			
26	Raising a Matrix to a Higher Power	7.3	pp. 362–367	7.3.1–7.3.3
27	Orthogonal Diagonalization	7.4	pp. 388–396	7.4.1–7.4.4
28	Quadratic Forms	7.4	pp. 417–425	7.4.5, 7.4.6
29	**Review**			
30	**Final Exam**			