MATH 369: Linear Algebra I

Section 002

Syllabus - Fall 2023

A. Course Information

Instructor: Baohua Chen

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Office: Weber 113

Meeting Time: MWF 12:00-12:50 pm in Engineering D102

Course Website: Canvas.colostate.edu

Office Hours: Monday, 1:00-2:00 pm, or by appointment

B. Prerequisites for Course

MATH161 (Calculus for Physical Scientist II) or MATH255 (Calculus for Biological Scientists II) or MATH278 (Applied Mathematics for Chemists I)

C. Course Description & Objectives

This is an introductory course on linear algebra, one of the most important and basic areas of mathematics, with many real-life applications. It focuses on linear equations, matrices, determinants, the theory of vector spaces and linear transformations, and the techniques such as row-reduction of matrices, diagonalization and orthogonality, which can be applied to problems in scientific computation, engineering, sciences, etc.

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

- Understand the basic theory of vector spaces: linear independence, spanning, bases, dimension of subspaces.
- Understand the basic theory of linear transformations: matrix representation, diagonalization, orthogonalization.
- Carry out the basic techniques: row-reduction to solve systems of linear equations, calculate matrix operations, finding inverse for a matrix, calculating determinants, finding eigenvalues and eigenvectors, diagonalizing matrices.

D. Outline of Instruction

1. Systems of linear Equations

   Augmented matrix for linear equations
   Row reduction and echelon forms
   Gaussian elimination with back-substitution; Gauss-Jordan elimination
   Solving a homogeneous system of linear equations
   Rank of a matrix

2. Matrices

   Matrix operations: addition, scalar multiplication, matrix multiplication, identity matrix, transpose of a matrix
   Finding the inverse of a matrix by row operations

3. Determinants

   Determinant of 2 by 2 and 3 by 3 matrices
   Minors and CoFactors of a square matrix
   Properties of determinants
   Cramer's Rule

4. Vector Spaces

   Vector spaces and Subspace
   Null, Column, and Row spaces of a matrix; Rank of a matrix
   Linear combinations; Linear independence
   Basis, Dimension, Finding a basis of a vector space
   Coordinates, Change of Basis

5. Linear (matrix) Transformations

   Linear Transformations; Matrix for a linear transformation
   Kernel and range of a linear transformations
   Change of basis

6. Eigenvalues and Eigenvectors

   Definition of eigenvalue and eigenvector
   Characteristics equation
   Diagonalization of a matrix
   Symmetric matrices

7. Orthogonality

   Inner products; Length
   Orthogonal vectors
   Orthonormal (Orthogonal) basis, Gram-Schmidt process
   Least-square approximations

E. Textbooks, Supplementary Materials, Software Requirements

1. Ken Kuttler, First Course in Linear Algebra, 10th Edition. (Required)
2. Howard Anton, Elementary Linear Algebra, 11th edition. (Optional)
3. Gilbert Strang, Introduction to Linear Algebra, 5th edition. (Optional)

Lyryx access code for Homework

- Online homework is provided. Students can access Lyryx form the CSU library computer bank free of charge. This is called "**Free Lab**"
- Students who wish to work on assignments elsewhere can pay a one-time/term convenience fee to the publisher Lyryx for $39.95 (or $19.95 if renewing). That will all you to log in form any device anywhere you please.

F. Instructional Methods and Activities

- **Lectures**: Class meets three times a week, and your attendance is expected in every session. Excessive absence may compromise your ability to succeed in the course.
- **Weekly Homework**: Lyryx Homework is assigned each Monday and due the following week Wednesday, except for exam week. The three lowest HW scores will be dropped at the end of semester.
- **Weekly Quizzes**: Short in-class quizzes will be given each **Friday**, excluding exam weeks. The three lowest quizzes will be dropped at the end of semester.
- **Midterm Exams**: Three in-class midterm exams are given on the select **Friday**: September 22, October 13, and November 10.
- **Final Exam**: A comprehensive final exam will be held during finals week. Based on our meeting time, the final exam will be Dec. 13, Wednesday, from 4:10-6:10 pm in the normal classroom.

G. Major Course Requirements and Grading

Your final grade is calculated according to the following percentages:

Activity	% of Final Grade
Homework	20 %
Quizzes	10 %
Midterm Exam1	15 %
Midterm Exam2	15 %
Midterm Exam3	15 %
Final Exam	25 %

Grading Scales: A: 90-100%, B: 80-89.99%, C: 70-79.99%, D: 60-69.99%, F: 59.99%-

H. Course Schedule

Week of	Monay	Wednesday	Friday
Chapter 1 and 2: Systems of Linear Equations and Matrices			
8/21/2023	Syllabus; 1.1 Systems of Equations, Geometry	1.2 Systems of Equations Gaussian Elimination	1.2 Systems of Equations Gaussian Elimination
8/28/2023	1.2 Rank and Homogeneous Systems	2.1, 2.2 Matrices Operations **HW1 Due**	2.3-2.5 Diagonal, Triangular, Symmetric Matrices, Transpose, Identity Matrix **Quiz 1(Gaussian elimination)**
9/4/2023	No Class	2.5 Inverse of a Matrix **HW2 Due**	2.6 Elementary Matrices **Quiz 2 (Matrix operations and Inverse matrices)**
Chapter 3: Determinants			
9/11/2023	3.1 Determinants	3.2 Application of Determinants **HW3 Due**	4.1-4.5 Vectors in R^n **Quiz 3 (Calculate determinant)**
9/18/2023	Review	Review **HW4 Due**	**Exam 1**
Chapter 4 and 9: Vector Spaces			
9/25/2023	4.8 Spanning and Linear Independence in R^n	4.9 Subspaces, Bases and Dimension	4.9 ~~Change of Basis~~ **Quiz 4 (Linear independence)**
10/2/2023	4.10 Three Spaces Related to Matrix	9.1-9.2 Abstract Vector Spaces **HW5 Due**	9.3-9.4 Linear Independence and Bases **Quiz 5 (Three spaces)**
10/9/2023	Review	Review **HW6 Due**	**Exam 2**
Chapter 5 Linear Transformations			
10/16/2023	5.1, 5.2 Linear Transformations matrix for different bases	5.3 Properties of Linear Transformations	5.4 Special Linear Transformations in R^2 (projection. Rotation. reflection) **Quiz 6 (Find Matrix for a linear transformation)**
10/23/2023	5.5, 5.6 One to One and Onto Transformations Isomorphisms	5.7 Range & Kernel of a Linear Map **HW7 Due**	5.8 General Solution of a Linear System **Quiz 7 (Range and Kernel)**
10/30/2023	5.8 General Solution of a Linear system	5.9 The Coordinates of a vector Relative to a Basis **HW8 Due**	5.10 Matrix of linear transformation **Quiz 8 (Transition matrix)**
11/6/2023	Review	Review **HW9 Due**	**Exam3**
11/13/2023	7.1 Eigenvalues and Eigenvectors of a Matrix	7.2 Similarity and Diagonalization	Real Symmetric Matrices **Quiz 9 (Find Eignvalues and Eignvectors)**
Chapter 7: Spectral Theory			
11/27/2023	7.3 Applications of Spectral Theory	7.4, 4.11 Orthogonality, Gram-Schmidt Process **HW10 Due**	Least square problems **Quiz 10 (Orthogonality)**
12/4/2023	Review	Review **HW11 Due**	Review

I. Important Dates

Aug. 21, Monday: Classes begin
Sep. 4, Monday: Registration closes- end of period for adding courses - last day for dropping courses without record entry, changes in grade option, and tuition and fee adjustment
Sep. 22, Friday (12:00-12:50 pm): EXAM 1
Oct. 13, Friday (12:00-12:50 pm): EXAM 2
Nov.10, Friday (12:00-12:50 pm): EXAM 3
Nov. 10, Friday: End Course Withdrawals ("W") Period, Repeat/Repair Deadline
Nov. 18, Saturday: Fall break begins-no classes next week.
Dec. 8, Friday: Last day of classes
Dec. 13, Wednesday (4:10 pm-6:10 pm): FINAL EXAM
Dec. 19, Tuesday: Grades due

J. Policies on Exams and Homework

Homework is due mostly on Wednesday midnight. No late homework submission.

If an exam is missed due to a university-sponsored activity (athletics, band, etc.), or for an emergency that could not have been planned for, that exam can be made up (documentation for an emergency event will be requested). Please inform the instructor as soon as you know that you will miss an exam to arrange an alternative time to take it. Exams missed without such a valid reason may not be made up and will earn zero points.

Policies on "Regrades": Graded exams will be handed back as quickly as grading can be completed. Grading errors occur from time to time, and will be corrected if found, Students are welcome to ask questions about how something was graded and can appeal for a change to the earned points if they believe the grader misread or misunderstood something written. Please review your returned work promptly when it is returned. Errors reported within one week of when the exam was handed back will be corrected. After one week, the instructor will not change the points (this is to prevent a flood of reviews of prior work at the end of a semester as students try to earn those last few points needed for a higher grade).

K. College and University Policies

Accommodation: If you require Student Disability Center (SDC) Accommodations for exams, you must make arrangements with SDC and provide formal documentation to the course coordinator and your instructor at least one week in advance of every exam.

Life Circumstances: If you are experiencing a serious, unexpected life circumstance that is affecting your ability to participate in the course fully, the best thing to do would be to confer with the CSU Student Case Management, which deals with these situations in a safe, confidential and professional manner. The URL is: https://studentcasemanagement.colostate.edu/

Academic Integrity

The University Policy on Academic Integrity is enforced in this course, and the academic honesty penalties for this class are quite serious and predicated on a philosophy that it is much better to not hand in an assignment at all then it is to hand one in dishonestly. We strongly advise you not to run afoul of the honesty code – it is simply not worth it. If you find yourself struggling in the course, the best thing to do would be to talk to your instructor or the coordinator about the issue, or to increase your time spent in the Calculus Center. All work submitted must be reflective of your own understanding. Uploading a question to the Internet, or using a solution which was either obtained online or otherwise authored in the main by another person, is strictly prohibited. Submitting work that is excessively similar to that of another students or that you cannot justify or explain adequately afterward is also considered academic dishonesty. The course policy is that if several assignments are found to be excessively similar, then academic honestly penalties will be incurred by all of the students in question. In other words, we do not distinguish between the student who copied a solution and the student who allowed their solution to be copied. This also includes situations where multiple students obtain a common set of solutions from a third party. Please note that simply having access to forbidden materials – such as notes, a calculator, a smart phone, etc – during an exam constitutes a breach of academic honesty, whether or not you are observed actually using them. Likewise, making misrepresentations to your instructor about any issue related to the operation of the course, providing fraudulent or misleading documentation, or otherwise creating a situation in which it is not possible to reliably assess whether or not your actions conformed to course and university policy is also considered a violation of the honesty code. Please remember that the penalties for such infractions are generally much more severe then a zero on the assignment itself, and it is usually not possible to pass the course after even one academic honesty infraction. Again, the best thing to do would be to steer clear of any honor code situations – as long as you have right prerequisites and participate in the course fully, all students should be able to pass the course on their own merit.

GENERAL DISCLAIMER

The course syllabus is a general plan for the course, modification of the schedules, assignments, deadlines, and course policies may be necessary. Instructors will announce such changes in a timely manner during regularly scheduled lecture periods.