

Goals and Learning Objectives

Course goals: In this course we study a branch of mathematics, called linear algebra, and some of its applications. Students of the course should master properties of matrices including how to use them to solve linear systems of equations and how they are used in linear transformations between vector spaces. Students are also expected to gain an appreciation for the applications of linear algebra to areas such as computer science, engineering, biology and economics.

Learning objectives: Upon successful completion of the course, students should understand the following:

- how to analyze and solve a linear system of equations;
- important characteristics of matrices, such as its four fundamental subspaces, rank, determinant, eigenvalues and eigenvectors, different factorizations, etc;
- how to use characteristics of a matrix to solve a linear system of equations or study properties of a linear transformation;
- important concepts of vector spaces such as independence, basis, dimensions, orthogonality, etc;
- properties of special categories of matrices such as symmetric, positive definite, etc;
- some applications of linear algebra in other branches of sciences, engineering, and economics.

Learning outcomes: Upon successful completion of this course, students should be able to perform the following:

1. determine the existence and uniqueness of the solution of a linear system, $A\vec{x} = \vec{b}$ and find all solutions by choosing an effective method such as Gaussian elimination, inverting A , a suitable factorization or diagonalization of A , etc;
2. find the dimension and basis of a given vector space;
3. write down the matrix representing a linear transformation (such as projection, rotation, dilation, etc.) under a given basis, and determine how the matrix changes if the basis is changed;
4. test for independence of vectors;
5. find the Gram-Schmidt orthogonalization of a matrix;
6. determine the rank, determinant, eigenvalues and eigenvectors, diagonalization, and different factorizations of a matrix;
7. identify special properties of a matrix, such as symmetric or Hermitian, positive definite, etc., and use this information to facilitate the calculation of matrix characteristics;
8. calculate the exponential of a matrix and use it to solve a linear system of ODEs with constant coefficients.
9. understand how the singular value decomposition (SVD) helps find lower dimensional structure in high dimensional data and is critical to search engines and data-science.

Program Learning Outcomes: Math 141 meets the following Program Learning Outcomes of the Applied Mathematics Program:

1. Solve mathematical problems using analytical methods.
2. Solve mathematical problems using computational methods.
3. Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
4. Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences.
5. Model real-world problems mathematically and analyze those models using their mastery of the core concepts.

Lectures

Purpose. In lectures, we will introduce new concepts, emphasize important aspects of the theory, and study illustrative examples.

Lecture Time/Room. TR, 4:30 – 5:45 pm in COB1 - 116 or [Zoom Meeting](#).

Instructor. Suzanne S. Sindi

E-mail address. ssindi@ucmerced.edu (Please put “Math141” in the subject line.)

Phone number. (209) 228.4224

Office. ACS 366

Office hours. W, 3 – 4pm and R, 2 – 3pm or by appointment. Until January 31, all office hours will occur at this [Zoom Link](#).

If the scheduled times I have posted do not work with your schedule, do not hesitate to reach out via email to set up a different appointment. Please make your time/availability clear to me in your email request.

Discussion Sections

Purpose. Discussion sections will help review concepts introduced in lectures and most importantly allow you to solve problems in collaboration with your peers and under the supervision of the discussion leader.

Discussion Section TAs.

- **Hardeep Bassi** (hbassi2@ucmerced.edu)
 - **Office.** ACS 358B
 - **Office hours.** Monday: 11:30am - 12:30pm, Wednesday: 10:30am-11:30am
 - **Discussion sections.**
 - * Section 02D, Monday from 2:30 pm – 3:20 pm in GRAN 150 or [Zoom Link](#)
 - * Section 03D, Wednesday from 4:30 pm – 5:20 pm in GLCR 135 or [Zoom Link](#).
- **Li-Hsuan Huang** (lh Huang33@ucmerced.edu)
 - **Office.** TBD
 - **Office hours.** Monday 10 - 11 am, Tuesday 1:30 - 2:30 pm, or by appointment. Until January 31, all office hours will occur at this [Zoom Link](#).
 - **Discussion sections.**
 - * Section 04D, Wednesday from 10:30 am – 11:20 am in GLCR 125 or [Zoom Link](#).

Course Materials

Textbook. *Linear Algebra and Its Applications*, 4th Edition, Gilbert Strang. We will cover most of the material from chapters 1 - 6 and, if time permits, some selected topics from chapters 7 and 8.

Course Webpage. The Math 141 website is part of the CatCourses course management system and is available to all students enrolled in this class. All important course materials will be posted there, and announcements about the course will be sent through the Announcement feature. Make sure you regularly monitor your UC Merced email address.

Outside Resources. Because Linear Algebra is such a fundamental topic, there are many resources available on-line for free that you may find helpful. The author of our textbook, Professor Strang, teaches a similar course at MIT, 18.06. The course website has lots of useful information:

<https://mitmath.github.io/1806/>.

In addition, nearly every college in the United States teaches a similar course. So many resources are freely available if you simply search for the specific topic we are covering in the course. In particular, [James Hamblin's YouTube Channel](#) appears to have many well-produced short videos covering classroom topics.

Course Evaluation and Grade Determination

Your final grade in the course will be based on the following break-down.

- Homework Quizzes (20%, your lowest three scores will be dropped)
- Discussion Section (20 %, your lowest three scores will be dropped)
- Video Projects (20 %; 10 % each for 2 Video Projects)
- Exams (40%; 3 Exams - including the final - your lowest exam score will be dropped)

If you obtain 90% in the course, you will definitely earn an A. If you obtain less than 55%, you will definitely earn an F. For everything in between, students will earn letter grades using the **approximate** framework: A: 90-100%, B: 80–90%, C: 70–80%, D: 60–70%. Please be aware that you need a C– or better to have this course fulfill any requirements for your major.

Details on Course Evaluation

- **Homework Quizzes:** Weekly homework assignments will be posted on the CatCourses website each Thursday morning. You are encouraged to complete the entire assignment during that week, but are not responsible for submitting it.

Instead, the following Thursday, a Homework Quiz based on this material will be posted to CatCourses. You will have 48 hours to take the Homework Quiz, and once you begin the quiz, you will have a total of 90 minutes. To accommodate unexpected situations, *your lowest 3 Homework Quiz scores will be dropped.*

In the days up to the Homework Quiz, you are encouraged to work in groups. However, you are not allowed to consult with anyone when you take the Homework Quiz. In addition, you must acknowledge any outside sources employed, including websites.

- **Discussion Section:** Each week students will be responsible attending and participating in weekly discussion sections. You are encouraged to work in groups of 3 or 4 during discussion sections. However, you must acknowledge the students you worked with and the work you submit must be your own.

You will be graded on participation out of 10 points. Grading will be effort based. Your attendance (5 points) and participation (5 points) is graded. To accommodate unexpected situations, *your lowest 3 discussion section scores will be dropped.*

- **Video Projects:** There will be two video projects this semester. The purpose of the video projects is for you to demonstrate your understanding of the concepts and being able to apply them to solve problems. You will be asked to record a short oral presentation on a topic that is randomly picked from a list we provide or you may suggest your own topic (subject to approval by the Instructors), and upload it to CatCourses. The 1st video project will be tentatively due by **11:00pm, Friday, March 18, 2022**, and the 2nd video project will be due by **11:00pm, Friday, May 6, 2022**.

Please submit your videos before the deadline, late video submission will not be accepted and we will trust the CatCourses time-stamp.

- **Exams:** There will be a total of three midterm exams - including the final. The final exam will be cumulative but have the same “weight” as the other exams. Because *your lowest exam score will be dropped* if you are happy with your score without the final exam, you do not need to take it.

The midterm exams are tentatively planned to be given in-person during lecture times and are *tentatively* scheduled during lectures on **Tuesday, February 22** and **Tuesday, April 12**. The final exam will take place on **Tuesday, May 10** from 8:00-11:00am in our regular classroom (COB 1 - 116).

Please bring your student ID to each exam. No calculator, notes or other resources may be used during exams. There will be no make-up exams! If you must miss an exam due to an emergency, please bring me a note verifying your circumstances.

Course Policies

Portable Electronic Devices. All portable electronic devices (e.g., cell phones, tablets, etc.) must be turned off and put away during exams. A calculator or laptop computer may be used in lectures and discussion sections, but if it is determined that these items are NOT being used appropriately you will be asked to put them away.

Grading Questions. Any questions about grading, either on a homework or assignment must be submitted in writing. You will attach your written concern or question to your original graded material and drop off your documents to either the TA (homework assignments) or Instructor (exam).

Additional Course Information

Dropping the course. You may drop this course without paying a fee and without further approval before **Monday, February 7, 2022** as described on the [University Academic Calendar](#). Dropping the course after this time requires the signed approval of the Instructor. Please see the [Registrar's Add Drop Policies](#) for more details.

Getting Help. You are encouraged to get help whenever you need it. In particular, it is highly recommended that regularly make use of outside resources even if you feel you understand the material. Linear algebra is highly conceptual, and one of the best ways to make sure you know the material is:

- You can explain it to someone else.
- You can understand an example presented outside the course.

The instructor and TAs have office hours and you are encouraged to visit not just for problems/questions - we'd like to get to know you! But you can definitely bring questions too. If you need additional help and are unable to attend these hours, additional meetings can be scheduled via email.

Special Accommodations. If you qualify for accommodations because of a disability, please submit a letter from Disability Services to the instructor in a timely manner so that your needs may be addressed. Student Affairs determines accommodations based on documented disabilities.

We will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please speak with me during the first week of classes regarding any potential academic adjustments or accommodations that may arise due to religious beliefs during this term.

Academic Integrity. Academic integrity is the foundation of an academic community and without it none of the educational or research goals of the university can be achieved. All members of the university community are responsible for its academic integrity. Existing policies forbid cheating on examinations, plagiarism and other forms of academic dishonesty. The UC Merced Academic Honesty Policy and Adjudication Procedures available are available on the website for [The Office of Student Rights and Responsibilities \(OSRR\)](#).

Inclusion and Diversity. We value all students regardless of their background, country of origin, race, religion, ethnicity, gender, sexual orientation, disability status, etc. and am committed to providing a climate of excellence and inclusiveness within all aspects of the course. If there are aspects of your culture or identity that you would like to share with course instructors as they relate to your success

in this class, we am happy to meet to discuss. Likewise, if you have any concerns in this area or facing any special issues or challenges, you are encouraged to discuss the matter with we (set up a meeting by e-mail) with an assurance of full confidentiality (only exception being mandatory reporting of academic integrity code violations or sexual harassment).¹

Pandemic Matters. Life sucks right now. None of us is really ok. **We're all just pretending.**

You most likely know people who have lost their jobs, have tested positive for COVID-19, have been hospitalized, of perhaps have even died. You all have increased (or possibly decreased) work responsibilities and increased family care responsibilities - you might be caring for extra people (young and/or old!) right now, and you are likely facing uncertain job prospects (or have been laid off!)

We're fully committed to making sure that you learn everything you were hoping to learn from this class! But also, know that we care about each of you as individuals. How you are doing in this course has no bearing on how you will be treated. If you tell an instructor or TA that you're having trouble, we will not judge you or think less of you. We hope you will extend us the same grace.²

As a student at UC Merced, we encourage you take advantage of the resources you have at your disposal for your mental health.

- As a student, you are eligible for [Counseling Services](#).
- The [Calm](#) meditation and wellness app is available for free for any student, faculty or staff member of UC Merced.

Remember, we are all in this together.

¹This inclusion statement was written by chemistry professor Dr. Steve Zimmerman at the University of Illinois at Urbana-Champaign. Source: <https://mobile.twitter.com/steveczimmerman/status/1161019135251353606>

²This statement was adapted from data science instructor Andrew Heiss at Georgia State University. Source: <https://twitter.com/andrewheiss/status/1293909055795105792>