MATH 3191-001: Applied Linear Algebra

Department of Mathematical and Statistical Sciences
College of Liberal Arts and Sciences, University of Colorado Denver

Instructor:	Stephan Patterson	Term:	Fall 2019
Office:	SCB-4208	Class Meeting Days:	Mondays & Wednesdays
E-Mail:	Stephan.Patterson@ucdenver.edu	Class Meeting Times:	9:30 – 10:45 am
Website:	https://ucdenver.instructure.com/	Location:	NC 1402

Office Hours: Monday/Wednesday 1:30-3:00 or by appointment

Associate Chair: Stephen Hartke; Stephen.Hartke@ucdenver.edu; 303-315-1721; SBC-4303
Course captain: Dmitriy Ostrovskiy; dmitriy.ostrovskiy@ucdenver.edu; SBC-4124

COURSE OVERVIEW

I. Description

Linear Algebra is the mathematics of vectors and matrices. These are the objects used to represent and transform data, and make linear algebra one of the most useful mathematical subjects in practice. Topics of the course include systems of equations, Gaussian elimination, LU-decomposition of matrices, matrix algebra, determinants, vector spaces, linear transformations, eigenvalues and applications. See *Tentative schedule* below for the list of topics.

Note: No co-credit with MATH 3195 Semester Hours: 3

II. Course Prerequisites: MATH 2411 (Calculus II).

III. Required Texts and Materials

Linear Algebra and its Application 5th Edition by David C. Lay et al., Pearson. The book is available as a hard copy or ebook.
MyMathLab access code, can be purchased with the book or separately.

Recommended Materials

Access to a computer algebra system with analytical and/or numerical capabilities (*Mathematica*, MATLAB, etc.)

IV. Online Homework

To access MyMathLab go to http://www.pearsonmylabandmastering.com/northamerica/. Under the **Register** tab click on **Student**. Proceed to '**OK! Register Now'**. You will need your University email address (which you check regularly), the **Course ID** which is: **patterson75775** and either a student access code or a valid credit card. If you purchased the text new at the bookstore it will have a student access code which gives you access to the homework software. If you use a credit card to purchase the software it comes with an eBook which you can use for the class.

Study organization

After class, read relevant sections thoroughly. Lectures are not the substitute for the reading. The breadth and depth of the subject cannot be covered in class – I will be able to highlight only the most important points. It's not possible to learn mathematics (especially applied mathematics) without solving problems. Talk with other students, seek help with me. Expect to spend about 8 hours a week studying for the class outside the classroom.

V. Assignments and Grading

Online Homework (10%): This will be assigned over MyMathLab and will be automatically graded by the computer. With this software you have unlimited attempts at a problem so you have every possibility of attaining a 100% on each of these assignments. Late assignments will be accepted on MyMathLab up until 5 days after the deadline with 10% of the grade taken off each problem *per day* solved after the deadline (but before dead-deadline). There will be 11 online assignments and *your lowest score will be dropped.*

Online assignments are due each Wednesday evening (11:00 p.m.)

Homework (15%): These written problems will be posted on Canvas. Many will come from the textbook but some will not. Everyone must submit their own, hand-written solutions, though I encourage you to work together, compare thoughts, and check your answers with technology. There will be 11 assignments and *your lowest score will be dropped.*

Written assignments are due each Wednesday afternoon at the end of office hours (3:00 p.m.)

Class Attendance & Participation (5%): I will be taking attendance using name placards, which will also be used for shuffling group assignments during class. During class time, I expect that you will participate actively with your questions and answering my questions. I will mix lecturing with problem solving. Expect to work in small groups on problems and answer my questions or help me with solving example problems. As this course is rather early in the morning, make every effort to be on time. Habitual tardiness or lack of class participation will also be taken into account on this part of your grade. You may miss 2 lectures without penalty; after this, each absence will lower this grade by 0.5%.

Exams (70%): There will be three in-class exams worth together 45% of your grade (each contributing equally) plus a final exam worth 25% of your grade. All exams are closed books, closed notes, but you will be allowed to bring 1 half-page of handwritten (by you) notes. If you cannot come to the exam for any *valid* reason (as determined by me), see me ahead of time to arrange testing for you. The midterms will cover all preceding sections not covered in the previous midterms (see schedule). Final Exam is comprehensive, it will cover all topics studied in the class.

Exam #1 on Wednesday, September 18th (during regular class time)
Exam #2 on Wednesday, October 16th (during regular class time)
Exam #3 on Wednesday, November 20th (during regular class time)
Final Exam TBA

Grading Scale

Percentage grade range	Letter grade
93 – 100	A
90 – 92.9	A-
87 – 89.9	B+
83 – 86.9	B
80 – 82.9	B-
77 – 79.9	C+
73 – 76.9	C
70-72.9	C-
67 – 69.9	D+
63-66.9	D
60-62.9	D-
0 – 59.9	F

VI. Course Schedule

Week	Day	Date	Sections	Topic/Reading	HW
1	Monday	8/19/19	**1.1**	Systems of linear equations	
	Wednesday	8/21/19	**1.2**	Row reduction and echelon forms	
2	Monday	8/26/19	**1.3**	Systems of equations as vector equations	
	Wednesday	8/28/19	**1.4, 1.5**	Matrix equations and linear systems	1
3	Monday	9/2/19		No Class – Labor Day	
	Wednesday	9/4/19	**1.7**	Linear independence	2
4	Monday	9/9/19	**1.8**	Linear transformation	
	Wednesday	9/11/19	**1.9, 1.6***	Matrix of linear transformation; applications	3
5	Monday	9/16/19	**2.1**	Matrix operations	
	Wednesday	9/18/19	**Exam #1**	**1.1-1.5, 1.7, 1.8**	
6	Monday	9/23/19	**2.2, 2.3**	Inverse of a matrix	
	Wednesday	9/25/19	**2.4, 2.5**	Partitioned matrices, Matrix factorizations	4
7	Monday	9/30/19	**2.5, 3.1**	Matrix factorizations, Introduction to determinants	
	Wednesday	10/2/19	**3.2**	Properties of determinants	5
8	Monday	10/7/19	**4.1**	Vector spaces and subspaces	
	Wednesday	10/9/19	**4.2**	Null and column spaces, and linear transformations	6
9	Monday	10/14/19	**4.3**	Linearly independent sets; bases	
	Wednesday	10/16/19	**Exam #2**	**2.1-2.5, 3.1-3.2, 4.1**	
10	Monday	10/21/19	**4.4**	Coordinate systems	
	Wednesday	10/23/19	**4.5**	Dimension of a vector space	7
11	Monday	10/28/19	**4.6**	Rank	
	Wednesday	10/30/19	**5.1, 5.2**	Eigenvectors and eigenvalues	8
12	Monday	11/4/19	**5.3**	Diagonalization	
	Wednesday	11/6/19	**5.5**	Complex eigenvalues	9
13	Monday	11/11/19	**5.6***	Application: Discrete dynamical systems	
	Wednesday	11/13/19	**6.1**	Inner Product, Length, and Orthogonality	10
14	Monday	11/18/19	**6.2**	Orthogonal sets	
	Wednesday	11/20/19	**Exam #3**	**4.1 – 4.6, 5.1 – 5.3, 5.5**	
	Fall Break	*11/25 - 12/1*			
15	Monday	12/2/19	**6.3**	Orthogonal projections	
	Wednesday	12/4/19	**6.5***	Applications: Least-squares problems	11
Final				**Comprehensive**	

** These sections will be homework only, and may be omitted if time does not permit. Any changes made to the schedule and covered material will be announced in class and posted on Canvas*

VII. Grade Dissemination

Graded homework and exams will be returned during the following class meeting. Course grades will be updated in the Canvas gradebook weekly, which can be found at https://ucdenver.instructure.com/. CU Denver utilizes web grading which is accessed through UCDAccess. Web grading information can be found by going to www.ucdenver.edu/student-services/resources/registrar/faculty-staff/

COURSE PROCEDURES

IX. Course Policies - Grades

Attendance Policy: Your course grade will not be dependent upon class attendance, ***however***, class lectures are a critical part of the learning process. Students who attend class on a regular basis tend to feel more prepared for assessments and hence perform better in the course.

CU Denver Student Attendance and Absences Policy can be found at:
http://www.ucdenver.edu/faculty_staff/employees/policies/Policies%20Library/OAA/StudentAttendance.pdf

Extra Credit Policy: No extra credit.

Assessment Make-up Policy:

- **Homework- No late homework will be accepted.** I do accept homework submissions through canvas or by email, so if you cannot make it to campus please do submit electronically.
- **Exams** -If circumstances arise that prevent you from attending an exam, please contact me ahead of time as I will be much more lenient. Unexplained absences will require hard evidence such as a death certificate, hospital paperwork, etc. You will have up to one week to make up an exam with documentation. This policy also applies to the **Final Exam.**

Incomplete Policy: Incomplete grades (I) are not granted for low academic performance. To be eligible for an Incomplete grade, students must (1) *successfully* complete at least 75 percent of the course, (2) have special circumstances (verification may be required) that preclude the student from attending class and completing graded assignments, and (3) make arrangements to complete missing assignments with the original instructor using a CLAS Course Completion agreement.

X. Course Policies – Technology and Media

Email – Students can communicate with me regarding attendance, meeting arrangements, grades, and/or questions regarding the course content, assignments, and due dates. You may also send me a message via Canvas. I will check by my CU Denver email and Canvas daily, excluding weekends.

Computing Technology – No computing technology is allowed on the exams and quizzes. You are welcome and encouraged to use a computer algebra systems when appropriate during the semester and you might need it for the application project.

XI. Getting Help

Instructor Office Hours/By Appointment Feel free to see me with questions not answered during lecture, additional explanation, or homework assistance.

Academic Success and Advising Center Helps new freshmen and transfer students through academic advising, schedule planning, time management, personal support and referrals to other on-campus resources.

Career Center The center assists and guides students with understanding and leveraging their skills, personality, values and interests as they choose an academic major and determine a career direction. Services include job search and strategies, resume development and writing, practice interviews and salary negotiation. Employers may benefit from online job posting, resume referrals, on-campus interviewing, career fairs, employer presentations, and networking events.

Disability Resources and Services Office. The University of Colorado Denver is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you have a disability or think you have a disability and need accommodations to succeed in this course, I encourage you to contact Disability Resources and Services (DRS) and/or speak with me as soon as you can. (DRS is located in Academic Building 1, Suite 2116, and at disabilityresources@ucdenver.edu.) I am committed to providing equal access as required by federal law, and I am interested in developing strategies for your success in this course.

Learning Resource Center The Center provides individual and group tutoring, Supplemental Instruction (SI), study skills workshops and ESL support. UCD students are eligible for 1 hour of free tutoring per week.

Scholarship / Resource Office Information about scholarships and guidance on the scholarship application process.

Student Life Office This office encourages students to take advantage of all of the academic resources, out-of-class learning and recreational opportunities that are available throughout the year at CU Denver.

The University of Colorado Denver provides many other services and resources. See http://www.ucdenver.edu/life/services/Pages/index.aspx

XII. Academic Honesty

Students are required to know, understand, and comply with the CU Denver Academic Dishonesty Policy as detailed in the Catalog and on the CLAS website. Academic dishonesty consists of plagiarism, cheating, fabrication and falsification, multiple submission of the same work, misuse of academic materials, and complicity in academic dishonesty. If you are not familiar with the definitions of these offenses, go to http://www.ucdenver.edu/academics/colleges/CLAS/faculty-staff/policies/Pages/DefinitionofAcademicDishonesty.aspx. This course assumes your knowledge of these policies and definitions. Failure to adhere to them can result in possible penalties ranging from failure of this course to dismissal from the University; so, be informed and be careful. If this is unclear to you, ask me. The College of Liberal Arts and Sciences (CLAS) Ethics Bylaws allow the instructor to decide how to respond to an ethics violation, whether by lowering the assignment grade, lowering the course grade, and/or filing charges against the student with the Academic Ethics Committee. Violating the Academic Honor Code can lead to expulsion from the University.

Definition of Academic Dishonesty

Students are expected to know, understand, and comply with the ethical standards of the University. In addition, students have an obligation to inform the appropriate official of any acts of academic dishonesty by other students of the University. Academic dishonesty is defined as a student's use of unauthorized assistance with intent to deceive an instructor or other such person who may be assigned to evaluate the student's work in meeting course and degree requirements. Examples of academic dishonesty include, but are not limited to, the following:

Plagiarism: Plagiarism is the use of another person's distinctive ideas or words without acknowledgment. The incorporation of another person's work into one's own requires appropriate identification and acknowledgment, regardless of the means of appropriation. The following are considered to be forms of plagiarism when the source is not noted:

1. Word-for-word copying of another person's ideas or words.
2. The mosaic (the interspersing of one's own words here and there while, in essence, copying another's work).
3. The paraphrase (the rewriting of another's work, yet still using their fundamental idea or theory).
4. Fabrication of references (inventing or counterfeiting sources).
5. Submission of another's work as one's own.
6. Neglecting quotation marks on material that is otherwise acknowledged.

Acknowledgment is not necessary when the material used is common knowledge.

Cheating: Cheating involves the possession, communication, or use of information, materials, notes, study aids or other devices not authorized by the instructor in an academic exercise, or communication with another person during such an exercise. Examples of cheating are:

1. Copying from another's paper or receiving unauthorized assistance from another during an academic exercise or in the submission of academic material.

2. Using a calculator when its use has been disallowed.
3. Collaborating with another student or students during an academic exercise without the consent of the instructor.

Fabrication and Falsification: Fabrication involves inventing or counterfeiting information, i.e., creating results not obtained in a study or laboratory experiment. Falsification, on the other hand, involves deliberately alternating or changing results to suit one's needs in an experiment or other academic exercise.

Multiple Submissions: This is the submission of academic work for which academic credit has already been earned, when such submission is made without instructor authorization.

Misuse of Academic Materials: The misuse of academic materials includes, but is not limited to, the following:

1. Stealing or destroying library or reference materials or computer programs.
2. Stealing or destroying another student's notes or materials, or having such materials in one's possession without the owner's permission.
3. Receiving assistance in locating or using sources of information in an assignment when such assistance has been forbidden by the instructor.
4. Illegitimate possession, disposition, or use of examinations or answer keys to examinations.
5. Unauthorized alteration, forgery, or falsification.
6. Unauthorized sale or purchase of examinations, papers, or assignments.

Complicity in Academic Dishonesty: Complicity involves knowingly contributing to another's acts of academic dishonesty.

Student Code of Conduct: As members of the University community, students are expected to uphold university standards, which include abiding by state civil and criminal laws and all University policies and standards of conduct. These standards are outlined in the student code of conduct which can be found at:

http://www.ucdenver.edu/life/services/standards/students/Pages/default.aspx