Syllabus **Spring 2024**

AMS 210 APPLIED LINEAR ALGEBRA

INSTRUCTOR:	Suil Oh
	(Tenured) Associate Professor, Department of Applied Math. & Statistics
CLASS:	Mon, Wed 5:00 pm - 6:20 pm, Room: B203
OFFICE:	Academic Building B523
OFFICE HOUR:	Tu 2:00-6:00 pm, or by appointment.
	I also welcome questions by email.
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OFFICE HOUR: 10:30-11:30 am Tu & 1-2 pm Wed

Text: Alan Tucker, *Introduction to Linear Algebra: Models, Methods and Theory*, XanEdu Publishing, 1995; ISBN: 9781506696720 Wiley

Course Outline:
An introduction to the theory and use of vectors and matrices. Matrix theory including systems of linear equations. Theory of Euclidean and abstract vector spaces. Eigenvalues and eigenvectors. Linear tranformations. May not be taken for credit in addition to MAT 211.

Homework: Homework will be assigned weekly (approximately), posted on Brightspace. Each homework needs to be turned in on the due date at the beginning of lecture. There will be approximately 10 homework sets, equally weighted. **No late homework will be accepted.** You may discuss homework problems with other students taking the course, with the TA, and with the instructor. But the work that you turn in should always be your own write-up, and you should show that you personally understand everything that you write. **Please make certain that your writing is neat and clear, and that you have expressed your reasoning, not just the final answer**.

Extra Credits: Some extra credit problems will be uploaded on Brightspace, and some will be given in classes from time to time.

Tests

Midterm:	Wednesday, April 1, in class
	Tuesday, May 14, in class
Final:	3:15-5:45 pm, Monday, June 10

Grading of Tests and Homework

Your total average score will be computed based on 5% Attendance, 15% Homework, 25% per midterm, and 30% Final. The final letter grade is assigned using the scale :

A: 93-100, A-: 90-92, B+: 87-89, B: 83-86, B-: 80-82, C+: 77-79,

C: 73-76, C-: 70-72, D+: 67-69, D: 63-66, D-: 60-62, F: < 60

Learning Outcomes

1. Become familiar with a diverse set of linear models and use them to interpret theory and techniques throughout the course:
    - a system of 3 linear equations in 3 unknowns
    - a Markov chain model
    - a dynamic (iterative) linear systems of equations
    - a general equilibrium model.
2. Compute and apply basic vector-matrix operations:
    - scalar products
    - matrix-vector products
    - matrix multiplication
3. Demonstrate diverse uses of scalar and vector measures of a matrix:
    - matrix norms
    - dominant eigenvalue and dominant eigenvector
4. Solve a system of linear equations using:
    - Gaussian elimination
    - determinants
    - matrix inverses
    - iterative methods
    - least squared approximate solutions using pseudo-inverses
5. Demonstrate how Gaussian elimination determines if a system of linear equations is:
    - overdetermined
    - underdetermined-and how to determine the family of solutions
    - uniquely determined-and find the solution
6. Apply basic ideas of numerical linear algebra:
    - computational complexity of matrix operations
    - LU decomposition
    - using partitioning to simplify matrix operations
    - ill-conditioned matrices and the condition number of a matrix

7. Learn and use basic theory about the vector spaces associated with a linear transformation:
    - linear independence
    - the null space
    - the range space
    - orthonormal spaces
8. Examine a sampling of linear models, chosen from linear regression, computer graphics, markov chains, and linear programming.
9. Strengthen ability in communicating and translating of mathematical concepts, models to real world settings present solutions to problems in a clear, well-laid out fashion;
    - explain key concepts from the class in written English
    - convert problems described in written English into an appropriate mathematical form
    - convert the mathematical solutions into a written answer

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

Americans With Disabilities Act

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Academic Affairs. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

Course Evaluations

Stony Brook University values student feedback in maintaining the high quality education it provides and is committed to the course evaluation process, which includes a mid-semester assessment as well as an end-of-the-semester assessment, giving students a chance to provide information and feedback to an instructor which allows for development and improvement of courses. Please click the the following link to access the course evaluation system: http://stonybrook.campuslabs.com/courseeval/

Attendance Policy

(1) All students of SUNY Korea are required to attend every class.
(2) Unexcused absences will affect seriously the student's final grade in the course.
(3) If a student has over 20% unexcused absence, the student's final course grade will be an 'F'.

Example)
i) If the class is a 150 minute class, and is held once a week, the 4th unexcused absence of a student will lead to an F grade of the course.
ii) If the class is a 75 minute class, and is held twice a week, the 7th unexcused absence of a student will lead to an F grade of the course.
iii) If the class is a 50 minute class, and is held three times a week, the 10th unexcused absence of a student will lead to an F grade of the course.
iv) In Intensive English Course (IEC), if a student misses the class more than 40 hours in a semester, the student will receive an F grade on the course.

(4) Students should report the reason of absence to the instructor in advance, or immediately after the absence.
(5) When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the instructor.
(6) The instructor of the course reserves the right to excuse absences.
(7) The course instructor may excuse the absence if the submitted documentation fulfills the conditions below.

i) Extreme emergencies (e.g. death in the family)
ii) Severe medical reasons with doctor's note (Not a slight illness)
iii) Very important events (e.g. national conference, official school event)

(8) At the end of semester, the course instructor should submit a copy of the attendance sheet to the Academic Affairs Office.

Tentative course schedule

Week	Date	Section	Material Covered
1	2/26		Syllabus & Sampler
	2/28	1.1 & 1.2	Mathematical Models & Systems of Linear Equations
2	3/4	1.2 & 1.3	Systems of Linear Equations & Markov Chains and Dynamic Models
	3/6	1.4	Linear Programming and Models Without Exact Solutions
3	3/11	1.5	Arrays of Data and Linear Filtering
	3/13	2.1 & 2.2	Examples of Matrices and Matrix Multiplication
4	3/18	2.3	0-1 Matrices
	3/20	2.4	Matrix Algebra
5	3/25	3.2	Solving Systems of Equations by Elimination
	3/27		Review
6	4/1		EXAM 1
	4/3	3.3	The Inverse of a Matrix
7	4/8	3.4	Solving Matrix Problems by Iteration
	4/10		No Class (Parliamentary Elections Day)
8	4/15	3.1	Solving Systems of Equations by Determinants
	4/17	5.1	Null Space and Range of a Matrix
9	4/22	5.2	Theory of Vector Spaces Associated with Systems of Equations
	4/24	5.4	Orthogonal Systems
10	4/29	5.4	Orthogonal Systems
	5/1	2.5	Scalar Measures of a Matrix: Norms and Eigenvalues
11	5/6		No Class (Substitute Holiday)
	5/8	5.5	Eigenvector Bases and the Eigenvalue Decomposition
12	5/13		Review
	5/**14**		EXAM 2
13	5/20	4.1	Linear Transformations in Computer Graphics
	5/22	4.1	Linear Transformations in Computer Graphics (Continued)
14	5/27	2.6	Efficient Matrix Computation
	5/29	3.5	Numerical Analysis of Systems of Equations
15	6/3	4.2	Linear Regression
	6/5		Review