COURSE DESCRIPTION	Vector spaces, linear transformations and matrices, inner product spaces, orthogonality, canonical forms, Hermitian matrices. This course will emphasize the use of computers for routine computations. Pre-requisite(s): MATH 330
COURSE FORMAT	In-Person, Dawson 106 TuTh 11:00AM–12:20PM, Aug 28, 2023–Dec 16, 2023
INSTRUCTOR INFORMATION	Sungju Moon, PhD **Primary Contact:** Use the Inbox tool within Canvas **Office Location:** Dawson 223 **Phone:** (702) 992-2725 **Email:** sungju.moon@nsc.edu Instructors use the Canvas Inbox and announcements to communicate about course-specific topics. All other official University communication is conducted using Nevada State University-issued e-mail addresses (e.g., @students.nsc.edu) in order to comply with the Family Educational Rights and Privacy Act (FERPA). If you need assistance accessing your NSU e-mail account, contact the NSU Support Center at 702-992-2400, menu option 3, or online at NSU Support Center. For more about this, see the Student Responsibilities page.
OFFICE HOURS	TuTh: 12:30–3:20PM, Fr: 3:30–4:50PM, or by appointment
E-MAIL RESPONSE TIME	You can generally expect a response to emails within 24-48 hours (or slightly longer over weekends or holidays). Feedback for completed discussions, quizzes, and assignments depends on the length and complexity of the activity and could take up to 10 days. For questions on the status of a completed assignment, discussion, or test please contact me.
REQUIRED TEXT(S)	Axler, S., *Linear Algebra Done Right*, 3rd ed., Springer. URL: https://link.springer.com/book/10.1007/978-3-319-11080-6 Full text PDF is available through the University library. If you are having trouble accessing the textbook, please contact the instructor.
REQUIRED SUPPL. MATERIAL	Certain assignments (e.g., labs) will require having access to a scientific computing software tool such as Octave or MATLAB. Octave is a free and redistributable alternative to MATLAB and is pre-installed on the classroom computers. For your personal computer, you can download GNU Octave available at https://octave.org/. Alternatively, if you are familiar with some other scientific computing software tools such as Python, Fortran, R, etc, you may complete your assignments using those; however, in-class demonstrations will be done using Octave.

Learning Outcomes

As the second course on linear algebra, this course will further generalize and expand upon the concepts and techniques first introduced in MATH 330, emphasizing proof-writing skills and numerical proficiency. In particular, there are two main objectives with each corresponding to the theoretical and numerical portions of the course, respectively:

- To gain deeper knowledge of the main topics in linear algebra including linear transformations, inner product spaces, invariant subspaces, spectral theorems, and Jordan form.
- To understand and implement some of the most widely-used numerical methods from applied linear algebra including matrix decomposition, least-square fitting, linear stability analysis, principal component analysis, and data assimilation via Kalman filter.

Class Schedule

See Page 6 of the course syllabus for the tentative class schedule. All dates are subject to change.

Assignment Description & Due Dates

Proofs (30%): Proof problems will be assigned on a weekly basis in class. The bulk of the assignments will be about proving the main statements and claims discussed in class. Due dates will typically be within 1 week of the dates assigned. If an assignment is submitted on or before the due date, students are allowed to "resubmit" the assignment for unlimited number of times until the next exam date. Resubmissions will be live-graded, meaning that students will present their solutions to the instructor and receive feedback on the spot. We will adopt mastery-based grading with the following point-system: (0pt) little or no progress has been made, (1pt) an attempt has been made with major flaws and/or incomplete solutions, (2pts) most of the required ideas are present but there are issues with proof-writing, (3pts) a fully correct solution and a well written proof.

Lab Assignments (50%): Each lab topic will typically be covered over the course of two weeks on "lab days" (1–2 sessions per each two-week-long interval). The lab assignments will require using a scientific computing software tool. Although most of the activities will be covered in class, each lab assignment will require a final lab report due the following "lab day". Lab reports must be accompanied by well-commented and runnable computer code. Students are encouraged to communicate and collaborate on the lab assignments, but each student must submit their own report.

***MyFavProbs* Presentation (10%):** Students will pick one problem (or a family of related problems) of their choice from the second half of the course and present solutions in class. The presentations will replace the final exam.

Exam Description

Midterm Exam (10%): One midterm exam will take place in person during class time. The tentative date for the midterm exam is **Tue, Oct 31**. Schedule a short meeting with the instructor to pick up and discuss your graded midterm.

Late Policy

When students miss work for medical and/or personal reasons, they should access the Student Absence Notification System.

Proofs may be "resubmitted" (see assignment description above) repeatedly for up to full credit until the next exam date if the the assignment was turned in on or before the initial due date. Late work will be accepted until the next exam date.

Lab assignments may be turned in late for reduced credit.

The following assignments may *not* be turned in late without explicit permission from the instructor:

- Midterm
- *MyFavProbs* Presentation

Grading Criteria

Your grade will be determined by the following rubric:
(Course Point Totals)—100%

- Proofs (30%)
- Lab Assignments (50%)
- MyFavProbs Presentation (10%)
- Midterm Exam (10%)

Grading Scale (Letter Grade and Point Range):

A	93% or higher	C	73%–76.99%
A-	90%–92.99%	C-	70%–72.99%
B+	87%–89.99%	D+	67%–69.99%
B	83%–86.99%	D	63%–66.99%
B-	80%–82.99%	D-	60%–62.99%
C+	77%–79.99%	F	less than 60%

Accessing Grades and instructor feedback

To access your grades and find all of the instructor's feedback, click on Grades in the course navigation menu. Scroll through the list until you find the new graded assignment (indicated by the blue dot to the left of the assignment name). Then click on the assignment name. You will see your grade. Below it you can click on Show Rubric to see the marked up rubric. Click on the paper title if you want to download the original document. (The instructor's marks or comments will not appear on the downloaded document.) Click on the box to the right of the paper title to see the Turnitin report. Click on View Feedback to see the paper marked up with the instructor's comments/corrections in DocViewer. The instructor's feedback is on the right. Accessing Grades will take you step-by-step through how to find all instructor feedback and see the marked-up paper and rubric.

Student Responsibilities

Students are responsible for reading, understanding, and abiding by the policies listed on the Student Responsibilities page and LASB-specific policies, including, but not limited to:

- Americans with Disabilities Act (ADA) Accommodations
- Student Email Policy
- Diversity and Inclusion Statement
- Appropriate Online and Video-Conferencing Behavior
- Video- or Audio-Recording Lectures
- Withdrawing from a Course
- Academic Resource
- Student Absence Notification
- Enrollment Cancellation for Non-Attendance
- Technical Support and Minimum Technical Requirements
- Military and Veteran Students
- LASB Academic Conduct Policy

Plagiarism, cheating, and copyright infringement

Plagiarism can involve directly quoting, summarizing, or paraphrasing the work of others without specifically citing sources, or handing in work that is not your own. For more on this see the Copyright, Plagiarism, and Citing Sources page.

Cheating can involve deception about your own work or about the work of someone else, and can include unauthorized giving or receiving of information in exams or other exercises or assessments. The use of books, notes, mobile devices, or other reference materials and/or collaboration with other students is strictly prohibited on all quizzes and exams unless specific permissions have been given by the professor. Violating this rule is considered cheating. All assignments, quizzes, and exams, for both in-person and online classes, are to be completed by each student individually, unless otherwise documented by the instructor.

Copyright infringement includes sharing or posting course materials on external websites or other locations; NSU instructors' course materials are their intellectual property and are protected under copyright.

Detailed explanations and examples of plagiarism, cheating, and other forms of academic misconduct can be found in the LASB Academic Conduct Policy and in the Academic Standards section of the NSU Student Code of Conduct. *You are responsible for reading, understanding, and abiding by these policies.*

The grade of 0 or F may be assigned for any assignment, quiz, or exam in which plagiarism or cheating is discovered; depending on the severity of the incident (including whether the student has previous incidents), a grade of F may be assigned in the course and a Student Conduct charge may be filed. Evidence of such dishonesty will be kept on file, and will not be returned to the student. Instructors have the responsibility to report such incidents to the Dean and the NSU Conduct Office. Serious penalties may be imposed, depending on the nature of the incident.

Turnitin

By taking this course, you agree that all required assignments may be submitted to Turnitin for detecting plagiarism. All submitted papers will be included as source documents in the Turnitin reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin service is subject to the Turnitin End-User License Agreement posted on the Turnitin site. If you do not agree, contact your instructor immediately.

Artificial Intelligence

Use Only With Acknowledgement. Students are allowed to use advanced automated tools (artificial intelligence or machine learning tools such as ChatGPT or Bard) on assignments in this course if that use is properly documented and credited. For example, text generated using ChatGPT version 4 (ChatGPT-4) should include a citation such as:

- "ChatGPT-4. (YYYY, Month DD of query). [Text of your query]. Generated using OpenAI. `https://chat.openai.com/`"
- Material generated using other tools should follow a similar citation convention.
- Students are responsible for ensuring the accuracy of any information provided by an AI tool.

Source: Adapted from the University of Delaware:
https://ctal.udel.edu/advanced-automated-tools/

Student Success Resources

At some point in the semester, you may require assistance for a variety of issues. Here is a brief list of helpful resources:

- Academic Advising Center
- Academic Success Center
- Writing Center
- Student CARE Team
- Financial Aid Office
- Mental Health Counseling

The Academic Resources page has various academic resources including the academic calendar; disability accommodations; library guides; plagiarism, copyright, and citation information; and veteran concerns.

If life circumstances are making it difficult for you to succeed, please reach out to me and let me know. I am willing to work with you to devise a plan for success or make recommendations for other support services on campus. For example, I may connect you with an Academic Advisor who can develop a personalized success strategy that will keep you on track to graduate and discuss any impacts to your financial aid. You can also contact Academic Advising directly at (702) 992-2160 or at `studentsuccess@nsc.edu`.

Emergency CARE Services

Emergency CARE Services—If you are struggling with hunger, unstable housing, safety, mental health worries or ANY other concerns, contact case manager, Laura Hinojosa. Together, we can help meet those needs. E-mail: laura.hinojosa@nsc.edu | Call: (702) 992-2514 | Website: www.nsc.edu/care

Course Schedule—All Dates are Subject to Change

Date	Agenda
29-Aug-23	Lesson 1: field, review of vector spaces
31-Aug-23	Lab 1: matrix decompositions
5-Sep-23	Lesson 2: subspaces, span, linear independence
7-Sep-23	Lab 1: matrix decompositions (cont.)
12-Sep-23	Lesson 3: bases, dimension
14-Sep-23	Lab 2: least squares
19-Sep-23	Lesson 4: vector space of linear maps
21-Sep-23	Lab 2: least squares (cont.)
26-Sep-23	Lesson 5: invertability
28-Sep-23	Lab 3: Markov chain, population and epidemiological applications
3-Oct-23	Lesson 6: invariant subspaces
5-Oct-23	Lab 3: Markov chain, population and epidemiological applications (cont.)
10-Oct-23	Lesson 7: eigenspaces and diagonal matrices
12-Oct-23	Lab 4: complex eigenvalues and stability analysis
17-Oct-23	Lesson 8: generalized eigenvectors
19-Oct-23	Lab 4: complex eigenvalues and stability analysis (cont.)
24-Oct-23	Lesson 9: decomposition of an operator
26-Oct-23	Review/Catch Up
31-Oct-23	Midterm Exam
2-Nov-23	Lab 5: EOF analysis for climate change
7-Nov-23	Lesson 10: characteristic and minimal polynomials
9-Nov-23	Lab 5: EOF analysis for climate change (cont.)
14-Nov-23	Lesson 11: Jordan form
16-Nov-23	Lab 6: data assimilation
21-Nov-23	Lesson 12: inner products
23-Nov-23	Thanksgiving Holiday
28-Nov-23	Lesson 13: orthonormal bases and linear functionals
30-Nov-23	Lab 6: data assimilation (cont.)
5-Dec-23	Lesson 14: self-adjoint and normal operators
7-Dec-23	Lesson 15: spectral theorem
12-Dec-23	Catch Up/Buffer
14-Dec-23	*MyFavProbs* Presentations