NAU NORTHERN ARIZONA UNIVERSITY

Course Title: MAT 316 Introduction To Linear Algebra

Term: Winter 2023

Instructor: TBA

Course Credit: 3

Mode of Instruction: Online

Course Description:

This course provides an introduction with numerical analysis of linear algebra. Systems of equations, matrices, vector spaces, linear transformations, eigenvalues will be covered. We will also study the major topics of computational linear algebra, including QR algorithm, singular value decomposition, methods for solving linear systems, least-squares problems, and calculation of eigenvalues. This course will enable students to study different algorithms for the same problem, comparing stability, and accuracy.

Course Prerequisites:

MAT 137 Calculus II; MAT 226 Discrete Mathematics

Learning Outcomes:

By the end of the course, the student should be able to:

A. Master the concepts and theories of numerical analysis of linear algebra;

B. Understand the matrix factorization methods for solving systems of linear equations and linear least squares problems;

C. Understand the basic computer arithmetic and the concepts of conditioning and stability of a numerical method;

D. Apply the basic numerical methods for computing eigenvalues;

E. Employ techniques to classify and solve linear systems of equations.

Course Material:

Numerical Linear Algebra, Holger Wendland, Cambridge University Press, 2017.

Evaluation:

- Assignments [10%*4]
- Term Paper [15%]
- Mid-term Exam [20%]
- Final Exam [25%]

Description of the Evaluation tasks:

Assignment/ Essay/ ... : During the term, students will be required to finish several evaluation tasks within due date. All the tasks are linked with specific course topics/ outcomes and will adequately assess students' competence and learning outcomes. Students are encouraged to meet with instructor about these tasks at any point.

Mid- term/ Final Exams/ Quiz/ ...: There may be periodic quizzes given at the beginning of lecture sessions; the feedback from these quizzes will monitor the progress of the learners and help to set learning priorities. There will be mid- term exam/ final exam for the course. They are the basic criteria for the evaluation of students' learning outcomes and final grade.

Grading Policy:

Students are supposed to finish each online lecture. Prior to each class, students should finish the required readings. During the class time, students are encouraged to make use of all relevant online course resources and communicate with the instructor. Students' grades are accumulated based on the cumulative evaluations.

Students' letter grade will be assigned according to the following scale:

A+ 90- 100	A 85-89	A- 80-84
B+ 77-79	B 73-76	B- 70-72
C+ 67-69	C 63-66	C- 60-62
D+ 57-59	D 53-56	D- 50-52
F < 50		

Academic Integrity:

Students must strictly adhere to the university' s academic integrity rule; and all essays, exams and any other form of academic assignments must adhere to these rules. Any form of plagiarism, cheating, or misappropriation of materials will be considered a violation of academic integrity and will be punishable by the university.

Withdrawal from the Course(s):

Students will be able to apply for a transfer or withdrawal within 3 days of the starting date of the course. If a withdrawal is applied for within 3 working days, the tuition fee will be fully refunded. After 3 days, the tuition fee will not be refunded. If a withdrawal is applied for in the first two weeks, it will be recorded as W (Withdraw) on the course transcript. After this initial two-week period, the class will be recorded as F (Fail).

Tentative Schedule:

Week 1	
1	Introduction: Examples Leading to Linear Systems
2	Singular Value Decomposition
3	Error
4	Stability and Conditioning
5	Direct Methods for Solving Linear Systems **Assignment #1**

Week 2	
6	QR Factorisation
7	Solving Least-Squares Problems
8	Iterative Methods for Solving Linear Systems
9	Calculation of Eigenvalues
10	The QR Algorithm **Assignment #2**

Week 3	
11	Computing the Singular Value Decomposition
12	Methods for Large Sparse Systems

13	**Midterm Test**
14	Methods for Large Dense Systems
15	Domain Decomposition Methods **Assignment #3**

Week 4

16	Notation
17	Facts from Linear Algebra
18	Norms for Vectors and Matrices
19	Gaussian Elimination
20	Symmetric Methods **Assignment #4**

Week 5

21	Preconditioning
22	Compressed Sensing
23	Numerical Algorithms
24	Final Exam Reviews **Term Paper**
25	**Final Exam**