NAU NORTHERN ARIZONA UNIVERSITY

Course Title: MAT 362 Introduction To Numerical Analysis
Term: Winter 2023
Instructor: TBA
Course Credit: 3
Mode of Instruction: Online

Course Description:

Introduction to numerical linear algebra and related numerical methods, topics include algorithms, computational errors, single variable equations, curve fitting, interpolation, numerical differentiation and integration, numerical solutions of differential equations, and linear systems of equations. We will also discuss orthogonal vectors and matrices, singular value decomposition, least squares problems, eigenvalues and Iterative methods. Assignments will be a mixture of theoretical and programming problems.

Course Prerequisites:

CS 122 Programming For Engineering And Science

MAT 239 Differential Equations

Learning Outcomes:

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

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

B. Learn the basic numerical methods for computing eigenvalues.

C. Distinguish and analyze a variety of tools that exist for solving linear systems and finding eigenvalues of these systems;

D. Explain how to implement and use these numerical methods in computer software package.

E. Choose an appropriate numerical method to solve linear systems, least squares problems, and the eigenvalue problem,

Course Material:

Richard L. Burden, J. Douglas Faires, Annette M. Burden, ***Numerical Analysis***, 10th Edition, Cengage Learning, 2015.

Lloyd N. Trefethen and D. Bau, ***Numerical Linear Algebra***, 1997.

Evaluation:

- Final Presentation [15%]
- 2 Assignments [10%]
- 2 Computer Project [30%]
- 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	Mathematical Preliminaries and Error Analysis
2	Round-off Errors and Computer Arithmetic
3	Algorithms and Convergence
4	Numerical Software
5	Solutions of Equations in One Variable **Assignment 1**
Week 2	
6	Interpolation and Polynomial Approximation
7	Numerical Differentiation and Integration
8	Direct Methods for Solving Linear Systems
9	Linear Systems of Equations
10	Iterative Techniques in Matrix Algebra **Computer Project 1**
Week 3	
11	Approximation Theory
12	Discrete Least Squares Approximation
13	**Mid-term Exam**
14	Orthogonal Vectors and Matrices
15	Singular Value Decomposition **Assignment 3**
Week 4	
16	QR Factorization
17	Least Squares Problems
18	Conditioning and Stability
19	Eigenvalues

20	Eigenvalues (Cont.) **Computer Project 2**

Week 5

21	Iterative Methods
22	Numerical Solutions of Nonlinear Systems of Equations
23	Numerical Solutions to Partial Differential Equations
24	Final presentation and Final Exam Review
25	**Final Exam**