

Dr. Donald Adongo, FH 6A-2
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Office Hours: By Appointment
Section 1 CRN 15564
Meeting: 1:30 – 2:20 pm MWF FH 108
<http://campus.murraystate.edu/faculty/dadongo>

DEPARTMENT: Mathematics and Statistics

COURSE PREFIX: MAT

COURSE NUMBER: 742

CREDIT HOURS: 3

I. TITLE:

Numerical Linear Algebra

II. COURSE DESCRIPTION AND PREREQUISITE(S):

Consideration of topics in numerical linear algebra: the Singular Value Decomposition, QR Factorization, Conditioning and Stability, Advanced Iterative Methods.

Prerequisite(s): MAT 642.

III. COURSE OBJECTIVES:

The student will be able to

- A. select or design a method or approach for solving a problem in numerical linear algebra;
- B. evaluate a method for its accuracy, stability and computational cost;
- C. use Matlab and other numerical software appropriately, that is, understand when to use certain methods and their limitations; and
- D. rigorously prove results in numerical linear algebra.

IV. CONTENT OUTLINE:

- A. Fundamentals: Matrix-Vector Multiplication; Orthogonal Vectors and Matrices; Norms; Singular Value Decomposition
- B. Projectors
- C. QR Factorization
- D. Gram-Schmidt Orthogonalization
- E. Householder Triangularization
- F. Conditioning of Least Squares Problems
- G. Stability of Least Squares Algorithms
- H. The Arnoldi Iteration
- I. GMRES
- J. Conjugate Gradients

V. INSTRUCTIONAL ACTIVITIES:

Lecture, daily assignments, group work, projects, reading assignments, and oral presentations.

VI. FIELD, CLINICAL, AND/OR LABORATORY EXPERIENCES:

Problems simulated using computer software like MatLab.

VII. TEXT(S) AND RESOURCES:

Applied Linear Algebra, Second Edition by Peter J. Olver and Chehrzad Shakiban, Springer

Other references: Trefethen, Lloyd N., Bau, David, *Numerical Linear Algebra*, (1997, June 1) SIAM
Golub, Gene, Van Loan, Charles, *Matrix Computation*, (4th Edition) Johns Hopkins University Press
Watkins, David, *Fundamentals of Matrix Computations*, (2010, July 6) Wiley

VIII. EVALUATION AND GRADING PROCEDURES:

A. **Grading:** Your grade will be based on EXAM grades, HOMEWORK grades, Lab (Computer) grades, and the FINAL EXAM. Forty two percent of the course grade will come from 3 major exams (each exam counts 14 percent of the grade) and twenty eight percent of the course grade will come from the final exam. The homework grade will contribute 15 percent while the lab grade is worth 15 percent of the course grade. The grading scale is

Grading Scale:

90 - 100 %	A
80 - 89 %	B
70 - 79 %	C
60 - 69 %	D
Below 60%	E

B. **Auditing:** If you seek to change your status to audit, you must continue to do all the graded assignments, to attend classes regularly, to do programming assignments, and to give an oral presentation.

IX. ATTENDANCE POLICY:

Students are expected to adhere to the MSU Attendance Policy outlined in the current *MSU Bulletin*.

X. ACADEMIC HONESTY POLICY:

Murray State University takes seriously its moral and educational obligation to maintain high standards of academic honesty and ethical behavior. Instructors are expected to evaluate students' academic achievements accurately, as well as ascertain that work submitted by students is authentic and the result of their own efforts, and consistent with established academic standards. Students are obligated to respect and abide by the basic standards of personal and professional integrity.

Violations of Academic Honesty include:

Cheating - Intentionally using or attempting to use unauthorized information such as books, notes, study aids, or other electronic, online, or digital devices in any academic exercise; as well as unauthorized communication of information by any means to or from others during any academic exercise.

Fabrication and Falsification - Intentional alteration or invention of any information or citation in an academic exercise. Falsification involves changing information whereas fabrication involves inventing or counterfeiting information.

Multiple Submission - The submission of substantial portions of the same academic work, including oral reports, for credit more than once without authorization from the instructor.

Plagiarism - Intentionally or knowingly representing the words, ideas, creative work, or data of someone else as one's own in any academic exercise, without due and proper acknowledgement.

Instructors should outline their expectations that may go beyond the scope of this policy at the beginning of each course and identify such expectations and restrictions in the course syllabus. When an instructor receives evidence, either directly or indirectly, of academic dishonesty, he or she should investigate the instance. The faculty member should then take appropriate disciplinary action.

Disciplinary action may include, but is not limited to the following:

- 1) Requiring the student(s) to repeat the exercise or do additional related exercise(s).
- 2) Lowering the grade or failing the student(s) on the particular exercise(s) involved.
- 3) Lowering the grade or failing the student(s) in the course.

If the disciplinary action results in the awarding of a grade of E in the course, the student(s) may not drop the course.

Faculty reserve the right to invalidate any exercise or other evaluative measures if substantial evidence exists that the integrity of the exercise has been compromised. Faculty also reserve the right to document in the course syllabi further academic honesty policy elements related to the individual disciplines.

A student may appeal the decision of the faculty member with the department chair in writing within five working days. Note: If, at any point in this process, the student alleges that actions have taken place that may be in violation of the Murray State University Non-Discrimination Statement, this process must be suspended and the matter be directed to the Office of Equal Opportunity. Any appeal will be forwarded to the appropriate university committee as determined by the Provost.

Note: Faculty reserve the right to invalidate any examination or other evaluative measures if substantial evidence exists that the integrity of the examination has been compromised.

VI. NON-DISCRIMINATION POLICY AND STUDENTS WITH DISABILITIES:

Policy Statement

Murray State University endorses the intent of all federal and state laws created to prohibit discrimination. Murray State University does not discriminate on the basis of race, color, national origin, sex, gender identity, sexual orientation, religion, age, veteran status, or disability in employment or application for employment, admissions, or the provision of services and provides, upon request, reasonable accommodation including auxiliary aids and services necessary to afford individuals with disabilities equal access to participate in all programs and activities.

In particular and without limiting the preceding and pursuant to and consistent with the requirements of Title VI of the Civil Rights Act of 1964 and its regulations 34 CFR 100 et seq.; Section 504 of the Rehabilitation Act of 1973 and its regulations 34 CFR 104; Title IX of the Education Amendments of 1972, 20 USC 1681 et seq., and its regulations 34 CFR 106 et seq; and the Age Discrimination Act of 1975 and its regulations 34 CFR 110, Murray State University does not discriminate on the basis of race, color, national origin, sex, handicap, or age in its educational programs and activities. This non-discrimination in education programs and activities extends to employment and admissions and to recruitment, financial aid, academic programs, student services, athletics, and housing. Murray State is required by Title IX and 34 CFR part 106 not to discriminate on the basis of sex and the prohibition against sex discrimination specifically includes a prohibition of sexual harassment and sexual violence.

For information regarding nondiscrimination policies contact the Executive Director of IDEA/Title IX Coordinator, Camisha Duffy, Office of Institutional Diversity, Equity and Access, 103 Wells Hall, Murray, KY 42071. Telephone: 270-809-3155 (Voice) 270-809- 3361 (TDD).

Students with Disabilities

Students with Disabilities: Students requiring special assistance due to a disability (temporary or permanent) should visit the Office of Student Disability Services immediately for assistance with accommodations. For more information, students with disabilities should contact the Office of Student Disability Services, Ken Ashlock, 423 Wells Hall, Murray, KY 42071. Telephone: 270-809-2018 (Voice) 270-809- 5889 (TDD).

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VII. OTHER REQUIRED DEPARTMENTAL OR COLLEGIATE COMMITTEE INFORMATION: