Syllabus: MATH 3325
Computational Linear Algebra

Instructor: Dr. Matthew Beauregard
Class Times & Place: T & Th 2:00-3:15pm,
STEM 108
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Office Phone: 936.468.4688
Office: STEM 207A
Virtual and Office Visits: Schedule an appointment at https://calendly.com/drbeauregard

Materials
- **Remind.com**: Please text the message @mth3325f20 to the number 81010.
- **Matlab** – Students can access Matlab through our virtual machines by using your SFA login/password at view.sfasu.edu (see instructional video on D2L).

Grading & Assessment
- (40%) Homework & Checkpoint Quizzes: Regular HW and Checkpoint quizzes will be available online in D2L. These will be submitted and returned through D2L.
- (30%) Summative Assessments: These will be delivered through D2L will not require a face-to-face component. Tentatively schedule for:
  - Friday, Sept. 18th, 2020
  - Friday, Oct. 16th, 2020
  - Friday, Nov. 13th, 2020
- (20%) Presentations & Projects: There will be projects that combine Matlab and analytical exploration of material. In addition, there will be video presentations assigned within regular or stand-alone assignments.
- (10%) Final Exam/Presentation: A final presentation will be held on Thursday, December 10, at 1:30pm through Zoom over a particular research topic in numerical linear algebra. Details will be provided by Friday, Nov. 13, 2020.

Livestream / Face-to-Face / Recordings
- Livestream – A Zoom link will be provided an accessible in D2L. During the livestream, please keep your video on and microphone off. When you have questions, please just unmic yourself and ask. Interruptions are encouraged!
- Face-to-Face – We'll be using STEM 108 throughout the semester. There will be blue tape indicating a “box” for you to situate yourselves. Please make every attempt to stay socially distant while entering or exiting the room. I’ll remain at the lectern and use the overhead to better facilitate the livestream and face-to-face audiences.
- Asynchronous viewing – Recordings will be available on D2L, expect for these two appear on D2L within 24 hours of our class day. This will allow for video-editing and splicing. There will be checkpoint assessments at the conclusion of each full or spliced video.
- All classes post-Thanksgiving will be facilitated through Livestream.
Course Description & Outline

- In this course you will investigate fundamental concepts of linear algebra in the concrete setting of $\mathbb{R}^n$ and explore their application to problems arising from mathematics, applied mathematics, and other fields. Prerequisites: MATH 2314/2114 (Calculus II).
- A tentative outline of the topics to be discussed is given below:
  1. Introduction to Linear Systems (Chapter 1 & 2 in Lay)
     - Solving linear systems and the augment problem.
     - Alternative representations of linear systems and their mathematical meaning.
     - Matrix algebra
     - Partitioned and Block matrices
     - Determinants (Chapter 3 in Lay)
     - Existence and uniqueness of solutions criteria
     - Invertible matrix theorem
  2. Introduction to Vector Spaces (Chapter 4 in Lay)
     - Measurement of vectors and the inner product
     - Basis for a vector space
  3. Eigenvalues and eigenfunctions (Chapter 5 in Lay)
     - Continuous dynamical systems
     - Discrete dynamical systems
     - Boundary value problems
  4. Fourier Series
     - Discrete Fourier series
     - Convergence and existence criteria
     - Fourier transform and FFT
  5. Least Squares, Regression, and Singular Value Decompositions
     - Revisiting the least squares approximation
     - Generalized least squares
     - Machine learning and mathematical modeling

Course Objectives

At the end of MTH 3325, a student who has studied and learned the material should be able to:

- Solve linear systems of equations either explicitly or numerically.
- Demonstrate understanding of various representations of linear systems and their interpretation in an array of physical, mathematical, and applied applications.
- Perform basic matrix calculations.
- Explain basic linear algebra concepts (subspace, span, linear independence, basis, dimension).
- Compute determinants of matrices.
- Determine and approximate eigenvalues and eigenvectors of matrix or operator.
- Diagonalize a matrix when applicable.
- Use eigenvalue and eigenvectors to solve systems of linear dynamical systems.
- Determine least squares solutions of linear systems.
- Determine a generalized fourier series and coefficients explicitly and numerically.
- Compute a singular value decomposition of a matrix.
University Policies

- Mask Policy for Face-to-Face Meetings and Class Discussion: Masks (cloth face coverings) must be worn over the nose and mouth at all times in this class and office visits and appropriate physical distancing must be observed. Students not wearing a mask and/or not observing appropriate physical distancing will be asked to leave the class. All incidents of not wearing a mask and/or not observing appropriate physical distancing will be reported to the Office of Student Rights and Responsibilities. Students who are reported for multiple infractions of not wearing a mask and/or not observing appropriate physical distancing may be subject to disciplinary actions.

- Academic Integrity (A-9.1) Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.
  
  Definition of Academic Dishonesty: Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one’s own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one’s paper without giving the author due credit. Please read the complete policy at [http://www.sfasu.edu/policies/academic_integrity.asp](http://www.sfasu.edu/policies/academic_integrity.asp).

- Withheld Grades Semester Grades Policy (A-54) Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average. The circumstances precipitating the request must have occurred after the last day in which a student could withdraw from a course. Students requesting a WH must be passing the course with a minimum projected grade of C.

- Students with Disabilities: To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004/468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to [http://www.sfasu.edu/disabilityservices/](http://www.sfasu.edu/disabilityservices/).

- Acceptable Student Behavior
  
  Classroom behavior should not interfere with the instructor's ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy D-34.1). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.

Disclaimer: Per SFA policy 5.4, this schedule and chosen exercises reflects that for each credit hour we will have one hour of faculty instruction with at least two hours of out-of-class student work per week. In other words, for an X credit hour class the student should expect X class hours of faculty instruction with 2 times X out-of-class hours of student work per week.