Department of Mathematics, University of Utah

Analysis of Numerical Methods, I
MATH 6610 – Section 01 – Fall 2017
Course Information and Syllabus
Updated November 12, 2017

Instructor:	Akil Narayan
Email:	akil@sci.utah.edu
Phone:	801-581-8984
Office:	WEB 4666
Office hours:	Wednesday 3-5pm, Thursday 9-11am, or by appointment
Office hours location:	WEB 4666

Class time and location: MWF, 11:50am-12:40pm, JTB (James Talmage Building) 120

Course webpage: http://www.sci.utah.edu/~akil/math6610
Note: Scores for graded assignments will be posted on Canvas.

Course Information: This is a 3-credit course.

Learning objectives: Upon successful completion of this course, a student should be able to:

- Understand, utilize, and manipulate standard metrics on vectors and matrices
- Analyze and compute standard matrix decompositions: QR, LU, SVD, Cholesky
- Formulate notions of conditioning and stability for linear and nonlinear problems
- Solve linear systems via direct and iterative methods
- Understand theory and algorithms for polynomial approximatinos
- Utilize polynomial approximations for differentiation and integration/quadrature

Course description: Mathematical analysis of numerical methods in linear algebra, interpolation, integration, differentiation, approximation (including least squares, Fourier analysis, and wavelets), initial- and boundary-value problems of ordinary and partial differential equations.

Text: L. N. Trefethen and D. Bau III, *Numerical Linear Algebra*, SIAM (1997), ISBN-10 0-89871-361-7.
E. Isaacson and H. B. Keller, *Analysis of Numerical Methods* (revised edition), Dover (1994), ISBN-13 978-0-486-68029-3.
Class lectures will *not* correspond directly to particular sections of either of the above texts. However, the texts above are considered mandatory reference texts: homework assigments will feature problems from these texts.
Homework will be graded for completeness and correctness: 50% of each homework grade will be awarded based on completeness of the assignment, and 50% will be awarded based on correctness for a random subset of problems.

Homework: Five or six homework sets will be assigned, collected, and graded throughout the semester. These assignments will be posted on the course website and announced in-class. Students will have approximately 1.5-2 weeks work time for each assignment. Late assignments of any form will *not* be accepted without **prior** approval from the instructor. Homework assignments will consist of analysis along with programming exercises. You are welcome to work on homework assignments in groups, but each student is required to hand in his/her own individually-composed and written ssignment.

Exams: This course will have 1 in-class midterm exam, and 1 final exam. The midterm exam will be held in class on Friday, October 6.

The final exam is a cumulative exam in the same format as the midterm exam. The final exam will be held on Wednesday, December 13 from 10:30am-12:30pm in the normal class meeting room, JTB 120.

Unless otherwise specified, **neither calculators nor notes of any kind are allowed on any of the exams**.

Grading: Your course grade will be computed as follows.

- Homework 40%
- Midterm exam 25%
- Final exam 35%

Final letter grades will be assigned based on the following scheme:

- 92% - 100% — A
- 90% - 91% — A−
- 88% - 89% — B+
- 82% - 87% — B
- 80% - 81% — B−
- 78% - 79% — C+
- 72% - 77% — C
- 70% - 71% — C−
- 68% - 69% — D+
- 62% - 67% — D
- 60% - 61% — D−
- 0% - 59% — E

Important dates:

Sept 1		Last day to add, drop (delete), elect CR/NC, or audit classes
Oct 6		Midterm 1
Oct 20		Last day to withdraw from classes
Dec 1		Last day to reverse CR/NC option
Dec 8		Reading Day
Dec 13	**10:30am**	Final exam

Class communication: An email list is set up with which I shall send out information not communicated during class. This email list will also be used to communicate class information in the case of unusual circumstances affecting the the logistics of the class. If you are not officially registered for the class but wish to be on the roster, please discuss it with me.

If you are registered for the course, but do not receive the course email announcements to your University of Utah email address, please notify me immediately. It is not possible for me to arrange delivery of these emails to a non-UUtah account.

The section website will also be used to communicate more technical matter of the class (e.g. problem sets, lecture summaries, etc.).

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to change that may be necessitated by a revised semester calendar or other circumstances. The above two methods, in addition to the coursewide website, are reliable means of getting information about changes to the course.

ADA Statement: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

Student responsibilities and integrity: All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from and class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee.
`http://regulations.utah.edu/academics/6-400.php`

Semester calendar

(Subject to change!)

Day	Date	Topic
Monday	August 21, 2017	Hello
Wednesday	August 23, 2017	Linear algebraic preliminaries
Friday	August 25, 2017	Singular value decompositions
Monday	August 28, 2017	No Class
Wednesday	August 30, 2017	No Class
Friday	September 1, 2017	No Class
Monday	September 4, 2017	No Class: Labor Day
Wednesday	September 6, 2017	Singular value decompositions
Friday	September 8, 2017	Projections
Monday	September 11, 2017	Orthogonalization and the QR decomposition
Wednesday	September 13, 2017	Algorithms: Gram-Schmidt
Friday	September 15, 2017	Algorithms: Householder
Monday	September 18, 2017	Linear least-squares problems
Wednesday	September 20, 2017	More on least-squares problems
Friday	September 22, 2017	Condition numbers
Monday	September 25, 2017	(IEEE) floating-point arithmetic
Wednesday	September 27, 2017	Linear stability
Friday	September 29, 2017	Linear stability, II
Monday	October 2, 2017	Applications of stability
Wednesday	October 4, 2017	Review
Friday	October 6, 2017	**MIDTERM EXAM**
Monday	October 9, 2017	No Class: Fall break
Wednesday	October 11, 2017	No Class: Fall break
Friday	October 13, 2017	No Class: Fall break
Monday	October 16, 2017	Linear systems: Gaussian elimination
Wednesday	October 18, 2017	Pivoting and stability
Friday	October 20, 2017	Cholesky factorizations
Monday	October 23, 2017	Cholesky factorizations
Wednesday	October 25, 2017	Eigenvalues and eigenvectors
Friday	October 27, 2017	Eigenvalues and eigenvectors
Monday	October 30, 2017	Algorithms: Power iteration
Wednesday	November 1, 2017	Algorithms: Inverse iterations
Friday	November 3, 2017	Algorithms: The QR algorithm
Monday	November 6, 2017	Iterative methods
Wednesday	November 8, 2017	Arnoldi iterations
Friday	November 10, 2017	No Class
Monday	November 13, 2017	Polynomial approximation and interpolation
Wednesday	November 15, 2017	Polynomial approximation and interpolation
Friday	November 17, 2017	Numerical integration
Monday	November 20, 2017	Numerical integration
Wednesday	November 22, 2017	No Class
Friday	November 24, 2017	No Class: Thanksgiving
Monday	November 27, 2017	Numerical differentiation
Wednesday	November 29, 2017	Lagrange interpolation, divided differences
Friday	December 1, 2017	Orthogonal polynomials
Monday	December 4, 2017	Gauss quadrature
Wednesday	December 6, 2017	Review
Friday	December 8, 2017	No Class: Reading day
Wednesday	December 13, 2017	**FINAL EXAM**