Mathematics 225
Linear Algebra and Differential Equations

Summer 2011

This is a tentative syllabus and is subject to revision. Last revised on 05/09/2011.

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Office Hours: To be decided

Teaching Assistants (TAs): Christian Keller and Stephen DeSalvo
Office Hours for TAs: To be announced

This course is constructed around the material present in the first seven chapter of the textbook "Differential Equations and Linear Algebra, Third Edition" by Goode and Annin.

Additionally, some material will be presented which is not covered in the textbook. Detailed notes will be provided, as will references, when available. The course emphasizes the intuitive understanding of linear algebra and differential equations, as well as an appreciation of the applications of the material.

We will cover the following topics in depth:
First-Order Differential Equations: first order linear differential equations, first order exact differential equations, change of variables and numerical techniques for solving differential equations. (2 lectures)
Matrices and Systems of Equations: Row and column operations, row-reduced echelon forms, Gaussian Elimination, Inverses of matrices, elementary matrices and the LU factorization, Invertible Matrix Theorem. (2-3 lectures)
Determinants: Definitions, Properties and Cofactor expansions.(1-2 lectures)
Vector Spaces: Definitions, subspaces, spanning sets, linear independence and dependence, finding bases, changing between bases, row and column spaces, Rank-Nullity theorem, inner product spaces, Gram-Schmidt orthonormalization algorithm. (4-6 lectures)
Linear Transformations: Definitions, writing transformations as matrices, Kernel and Range, Properties, Eigenvalues and Eigenvectors, Diagonalization, Matrix Exponentials, Orthogonal diagonalization and quadratic forms, Jordan Canonical Forms (2-4 lectures)
Linear Differential Equations of Order n: General Theory, constant-coefficient homogeneous equations, the method of undetermined coefficients, complex-valued trial solutions, the method of variation of parameters, order reduction and other topics (2-4 lectures)
Systems of Linear Equations: General results for first order systems, Variation of parameters for linear systems, the phase plane for linear autonomous systems. (2 lectures)
Applications: Simple population models, Portfolio immunization using convexity analysis, RLC circuits, Oscillations of a mechanical system, Applications of linear systems of differential equations (2 lectures)

Homework: There will be weekly assignments. Assignments are to be turned in during the lecture on the due date. No late assignments will be accepted. While you are encouraged to discuss with your colleagues, you must write each assignment on your own, in your own words, and you must show all work.

The TAs will grade each homework assignment in detail. You may ask for feedback on the assignment in office hours, or in your discussion classes. Each TA will grade half the homework. You will be expected to spend between 7-10 hours a week on self-study; this includes the amount of time you are expected to spend on your homework.

Exams: There will be one midterm exam and one final exam. These may be take home or online exams. The Final exam will be as per the University Exam Schedule. You will not be assigned a grade unless you take the final, and according to a strictly enforced university policy, you may not take the final early. Please keep this in mind when planning your holiday travel.

The midterm will test roughly half the syllabus. The final exam will be comprehensive.

Exam Dates: If the exams are in-class exams, they will happen on the dates below. If the exams are take-home exams, they will be due on the dates below.
Midterm: Thursday, June 9, 2011. **Final:** Tuesday, July 5, 2011.

Grades: Final 40%, Midterm 30%, Homework 30%.

Pace: Courses in the summer tend to progress at break-neck speed. You must keep up with the material as it is covered in class. Each week in the summer session is equivalent to two weeks in the regular semester. Therefore, you must multiply by a factor of two the amount of time you would spend studying the material in the regular semester.

Online Resources: Homework assignments, class schedule, syllabus and other useful information are posted on Blackboard. Students are expected to go the class homepage and check frequently. Scores for assignments will also be posted on Blackboard. Blackboard will also be used to send email announcements to the class. Students should ensure that the email registered with Blackboard is one they check regularly.

Behavior: Students must strive to create a friendly academic atmosphere in the classroom. Disruptive behavior will not be tolerated. Since making mistakes is a normal part of learning, students are not permitted to make disparaging or hostile comments at any time. The use of cell phones during class or discussion is disruptive behavior and will not be tolerated.

Academic Integrity: Students will abide by the USC academic integrity policies at all times. In particular, collaboration, use of notes or any electronic device, including phones, mp3 players, laptops, etc, during quizzes and exams is strictly prohibited. Failure to abide by this policy will result in a score of 0 on that section of class grade and referral to the Dean of students.