Math 244: Linear Analysis I

Spring 2024

Instructor:	Dr. Stathis Charalampidis	**Office:**	25-319 (Faculty Offices East)
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Course Web Page: https://www.egcharalampidis.com/teaching/244_S24/math_244_S24/

Class Meetings:

- Section 2 (TR): 9:10-11:00am (38-148)

- Section 8 (TR): 12:10-2:00pm (38-219)

Office Hours: TR 11:15am-12:00pm & 2:15-3:00pm, or by appointment.

Required Textbook:

- *Differential Equations and Linear Algebra*, Authors: Stephen Goode and Scott Annin, Publisher: Pearson.

Objectives: This course is the first part of the Linear Analysis sequence (Math 244-Math 344) offered at Cal Poly San Luis Obispo covering foundational methods and techniques primarily used for (linear) ordinary differential equations (ODEs) and systems theoref. In particular, this course introduces and discusses first-order ODEs, techniques for solving modeling problems (associated with the latter), fundamental linear algebra notions (such as vectors spaces as well as eigenvalues and eigenvectors) that will be used later in systems of ODEs, as well as ODEs of order n and systems of ODEs. A detailed course outline containing the learning objectives for this class may be found at

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https://content-calpoly-edu.s3.amazonaws.com/math/1/documents/244.pdf

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Class Material by Topic: During the quarter, we will cover the following topics from the main textbook:

- First-order ODEs.
- Matrices and systems of linear (algebraic) equations.
- Vector spaces, determinants, eigenvalues and eigenvectors.
- Higher-order linear ODEs and systems of ODEs.

Tentative Schedule:

- **Week of 4/1**: Basic ideas and notions of first-order ODEs. Separable ODEs (1.1-1.4).
- **Week of 4/8**: Modeling with first-order ODEs (1.6-1.7); Introduction to matrices (2.1-2.2).
- **Week of 4/15**: Matrix algebra, systems of linear equations and Gaussian elimination (2.3-2.6).
- **Week of 4/22**: Determinants (3.4), vector spaces (4.1 & 4.3-4.4), and bases (4.5-4.6); The eigenvalue problem (7.1).
- **Week of 4/29**: Diagonalization (7.2 & 7.3); General theory for linear ODEs and constant coefficients ODEs (8.1-8.2).
- **Week of 5/6**: Method of undetermined coefficients (8.3); Oscillations of mechanicals systems (8.5).
- **Week of 5/13**: RLC circuits and the variation of parameters method (8.6-8.7; if time permits)
- **Week of 5/20**: ODEs with non-constant coefficients and the method of reduction of order (8.8-8.9; if time permits); First-order linear systems of ODEs (9.1).
- **Week of 5/27**: Vector formulation, general results for systems of first-order linear ODEs (9.2-9.3).
- **Week of 6/3**: Vector DEs: defective/non-defective matrix (9.4-9.5); Matrix exponential and phase plane (9.8-9.9) if time permits.

Course Prerequisites: Math 143 or equivalent.

Homework and Exams: In every Mathematics course, it is extremely important you put your best effort towards solving problems and producing high-quality homework. Alongside this, it is also important to learn how to communicate your mathematical reasoning.

In that light, there will be (almost) weekly **written** homework assignments that will be posted in Canvas. Each assignment will consist of a group of problems and your task will be to write up solutions for each one.

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No late homework will be accepted.

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Please keep in mind that you will be rewarded not only for getting a correct answer but most importantly for the structure and presentation of your work.

Of course, struggling through a question in the homework is not something unusual. Mathematics is all about **studying** and **practicing** and the only way to learn is for you to work through any difficulties. With that said, and before you make an attempt to solve the homework problems, make sure that you write the accompanying theory down on a piece of paper as many times as possible until you master it. Then, come back to the problems in the homework assignment and attempt to solve them. Such a way of studying will not only help you to create your own study guide but to understand the material in depth. Keep in mind that in order you to get the best grade you can, the first step is to do every assignment to the fullest extend of your ability.

There will be **one in-class exam** and **one cumulative final**. For their schedule, see below the "Important Dates" section of this document. Before **any exam**, I will hold outside the regular class time review sessions according to:

Review session for midterm .... Thursday, May 2, TBA
Review session for final .... Thursday, June 6, TBA

In all review sessions, we will be solving practice problems. Most importantly, please collect any of your questions and I would be more than happy to answer them!

Grading Policy and Exams: Your final grade in this course is computed according to:

Homework 25%
Midterm 35%
Final Exam 40%

Important Dates and Academic Holidays:

Memorial Day .... Monday, May 27
(Monday schedule is followed on Tuesday, May 28)
Midterm .... Tuesday, May 7
Last day of classes .... Friday, June 7
Final Exam (Section 2) .... Tuesday, June 11, 10:10am-1:00pm
Final Exam (Section 8) .... Thursday, June 13, 1:10-4:00pm

Class and Exams Policies:

- Please **turn off your phone** during lecture.
- **Photos or any type of recordings** during lecture **are prohibited** unless you have an official accommodation from the DRC.
- **Attendance is mandatory**. However, an **excused absence** can be allowed only if the reason for your absence falls into any of the categories listed in the following page:

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https://academicprograms.calpoly.edu/academicpolicies/class-attendance

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  Please inform me as soon as possible if you are seeking to make up missed work pursuant to the excusable reasons listed in the url above.
- All exams are **paper and pencil** exams.
- All exams will be closed-book. Exams are primarily based on the material we cover in class and the homework.
- Absolutely no formula sheets, class notes and calculators are allowed during midterm and final exams. If a calculator is needed in an exam, I will inform you way in advance.

Students with Disabilities: The University provides disability-related support services to qualified students through the Disabilities Resource Center (DRC). If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both me and the DRC (124-119) at (805) 756-1395, as early as possible in the term. In addition, and for your convenience, their website is `https://drc.calpoly.edu/`. Note that use of DRC services including testing accommodations requires prior authorization by the DRC and compliance with approved procedures. **Make sure you initiate any needed arrangements well in advance of an exam date**.

Diversity and Inclusion: I am fully committed to an academic environment that is free of bias against any group and I firmly believe in the value of diversity in people and ideas. My ultimate goal is to establish that this class is a welcoming environment to every-one regardless of gender identity, sexual orientations, color, race, ethnicity, or religious identity. The University and I do not tolerate discrimination. Please feel comfortable coming to me if at any point you ever feel uncomfortable for any reason.