What is this course *really* about?
aka My aim for this course

According to Underwood Dudley, there are at least eight levels of mathematical understanding:

1. Being able to do arithmetic
2. Being able to substitute numbers in 'formulas'/ being able to state or use elementary properties of concepts
3. Given 'formulas'/ elementary properties of a concept, being able to get other 'formulas'/ elementary properties
4. Being able to understand hypotheses and conclusions of theorems
5. Being able to understand the proofs of theorems, step by step
6. Being able to *really* understand proofs of theorems: that is, seeing why the proof is as it is, and comprehending the underlying ideas of the proof and its relation to other proofs and theorems
7. Being able to generalize and extend theorems, and apply them to seemingly unrelated problems
8. Being able to see new relationships, and discover and prove entirely new theorems.

The word 'theorem' is used above in a very general sense - it can also represent algorithms and techniques with a mathematical basis.

Levels 5 and 6 would be considered basic mathematical ability for Math majors. Non-trivial applications of Mathematics would lie in-between levels 6 and 7. While levels 7 and 8 constitute research in Mathematics. A lot of Engineering and Physics is deep applied Mathematics and requires mathematical understanding at or beyond levels 6 and 7.

Calculus courses focus on a mixture of 1 and 2. Math 230 (Introduction to Discrete Mathematics) focuses on 3 and 4. This course (Math 332) on Elementary Linear Algebra focuses on 3 and 4 with a bit of 5.

For many of you this will be the first time proofs are featured so prominently in a course, and the first time you study abstract mathematical structures. Both these aspects are the primary feature of all upper-level math courses. How do we give precise mathematical description of technical problems/ ideas/ concepts/ strategies that arise naturally in applications? How do we delineate the underlying conceptual core of various mathematical structures - from low-dimensions to high dimensional geometry and on to algebra and vector spaces? How do we read, understand, and create mathematical arguments to explore these mathematical structures? This course aims to help you transition to this new way of thinking and doing mathematics.

I hope this course will help you make progress through these levels of mathematical understanding, and mathematical maturity. I would consider this a successful course, if you gain confidence in your ability to read, understand, and write mathematical arguments (including proofs), especially as compared to the beginning of the semester. And, you feel that you can read, understand, and apply any other topic/ technique in Linear Algebra that you might need later on in your career.

with best wishes,
Hemanshu Kaul