"Analysis II", Fall 2025.

Course description. *This course is a natural continuation of our Analysis I course. A rigorous understanding of sequence limits and continuity enables us to introduce other key concepts of Real Analysis: differentiation, integration, and power series. We have structured the course to provide you opportunities to collaboratively prove all theorems with your peers. Several days before each class, you will receive lecture notes containing definitions, examples, and propositions to be proved. In class, we will discuss your approaches, comments, and any questions you may have.*

Program of the Course.

1. Definition of the derivative.
2. Newton's approximation.
3. The Leibniz rule.
4. Chain rule.
5. Inverse functions and their derivatives.
6. The number e.
7. Derivatives of the exponential and logarithmic functions.
8. Local maxima, local minima, and derivatives. Rolle's theorem.
9. Mean value theorem.
10. Generalized Mean Value Theorem
11. Darboux's theorem
12. L'Hôpital's rule.
13. Derivatives of higher order.
14. Taylor's theorem.
15. Power series. Abel's test.
16. The trigonometric functions.
17. Partitions of a closed interval and piecewise constant functions.
18. Upper and lower Riemann integrals.
19. Basic properties of the Riemann integral.
20. Riemann integrability of continuous functions.
21. Riemann integrability of monotone functions.
22. A non-Riemann integrable function.

23. The Riemann-Stieltjes integral.
24. The two fundamental theorems of calculus.
25. Consequences of the fundamental theorems.

Recommended Textbooks.
T. Tao, Analysis I.
V. Zorich, Mathematical Analysis I.
W. Rudin, Principles of Mathematical Analysis.
S. Abbott, Understanding Analysis.
T. Apostol, Mathematical Analysis.
J. Cummings, Real Analysis.

Grading Rules. You should write a solution to at least four problems before the last class of each non-exam week. You will get 1 point for every correct solution but no more than four points for each week. Only your best 11 weeks' results out of 13 non-exam weeks will count. In each of the two exam weeks you should write a solution to at least two problems. Additional bonus points may be awarded for the shortest and most elegant solutions or solutions for the most complicated exercises. Both the midterm and the final exam are oral exams, open books, and open notes. The midterm contains 5 problems for 3 points each, and the final exam – 5 problems for 4 points each. Also, you get one bonus point each time you are the first to correct the professor's error during the lecture. The grading table has the following form:

A+	90%
A	85%
A-	80%
B+	75%
B	70%
B-	65%
C+	55%
C	50%

C- 45%

D 35%

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