MATH 151C
Foundations of Real Analysis III

Course Description
Rigorous development of mathematical analysis III. Topics include metric spaces, open and closed sets, connected sets, closure and boundary, convergent sequences, Cauchy sequences, completeness, compactness, Heine-Borel theorem, continuity, uniform continuity, limits, differentiability for vector valued functions of several variables, the chain rule in vector calculus, gradients, curves, partial derivatives, continuity and the derivative, inverse and implicit function theorems.

Prerequisites
MATH 131 with a grade of C- or better; MATH 151B with a grade of C- or better; or equivalent; or consent of instructor.

Textbook
Basic Analysis I, Introduction to Real Analysis, Volume I (Version 6.0, 2023) by Jiri Lebl
ISBN-10: 1718862407

Basic Analysis II, Introduction to Real Analysis, Volume II (Version 6.0, 2023) by Jiri Lebl
ISBN-10: 1718862407

Additional Resources
An Introduction to Analysis (4th edition, 2009) by Williams R. Wade
ISBN-10: 0132296381

Principles of Mathematical Analysis (3rd edition) by Walter Rudin
ISBN-10: 0070856133

Suggested Lecture Schedule

Week #	Textbook Section(s)	Topic(s)
1	7.1, 7.2	Metric spaces, open and closed sets, connected sets, closure and boundary
2	7.3, 7.4	Convergent sequences, Cauchy sequences, completeness, compactness
3	7.4, 7.5	Heine-Borel theorem, continuity, compactness and continuity, uniform continuity, cluster points and limits of functions
4	7.6 (Lebl), 10.7 (Wade)	Fixed point theorem, Picard’s theorem on existence and uniqueness, Stone-Weierstrass theorem
5	8.1	Vector spaces, linear mappings and convexity
6	8.2	Analysis on vector spaces
7	8.3	The derivative: differentiable functions, differentiability and continuity, partial derivatives, gradients, curves, directional derivatives, the Jacobian

8	8.4	Continuity and the derivative, continuous differentiable functions
9	8.5	Inverse and implicit function theorems
10	11.7 (Wade)	Optimization: the second derivative test in $\mathbb{R}^n$ and Lagrange multipliers