List of topics – Basic Real Analysis Course

Preliminary Material. Topology Basics: Real numbers, set topology, metric spaces.

Topology and continuous functions

1. Baire category theorem
2. Urysohn theorem, extension theorem
3. Spaces of continuous functions, Stone-Weierstrass theorem, Arzela-Ascoli theorem

Measures and Measuring

1. Sigma – Algebra of sets, Borel sigma-algebra
2. measurable functions
3. Monotone Class Lemms
4. Measures, measure space, regular measure, signed measures
5. Fatou Lemma
6. Completion, extension and measure generation, Caratheodory theorem

III. Integration

1. Definition and properties
2. Monotone convergence, Fatou lema, Lebesgue's dominated convergence theorem, parameter dependence

IV. Spaces Lp

1. Holder Inequality, Minkowski inequality
2. Riesz-Fischer Theorem
3. Density theorems

V. Convergence Types

1. Convergence on measurement, near-anywhere convergence, near-uniform convergence, relations among them
2. Uniform Integrability

VI. Measure Decomposition

1. Hahn decomposition and Jordan decomposition of signed measurements
2. Radon-Nikodym Theorem
3. Variables change
4. Lebesgue decomposition

VII. Product Measurements

1. Fubini Theorem
2. Measurement Disintegration

VII. Integral of Lebegue-Stieltjes on R

1. Lebegue-Stieltjes Measurements
2. Absolutely continuous function
3. Function of limited variations
4. Fundamental theorem of calculus
5. Convolution

Reference

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