First Semester Area A—CAM Option

CSE 386C/M 383C, Methods of Applied Mathematics I

1. Preliminaries

1.1. Elementary Topology
1.2. Lebesgue Measure and Integration
1.3. Complex Contour Integration

2. Normed Linear Spaces and Banach Spaces

2.1. Basic Concepts and Definitions
2.2. Some Important Examples
2.3. Hahn-Banach Extension Theorems
2.4. Applications of Hahn-Banach
2.5. The Open Mapping Theorem
2.6. Uniform Boundedness Principle
2.7. The Embedding of X into its Double Dual X^{**}
2.8. Compactness and Weak Convergence in an NLS
2.9. The Dual of an Operator

3. Hilbert Spaces

3.1. Basic Properties of Inner-Products
3.2. Best Approximation and Orthogonal Projections
3.3. The Dual Space
3.4. Orthonormal Subsets
3.5. Weak Convergence in a Hilbert Space

4. Spectral Theory and Compact Operators

4.1. Definitions of the Resolvent and Spectrum
4.2. Basic Spectral Theory in Banach Spaces
4.3. Compact Operators on a Banach Space
4.4. Bounded Self-Adjoint Linear Operators on a Hilbert Space
4.5. Compact Self-Adjoint Operators on a Hilbert Space
4.6. The Ascoli-Arzelà Theorem
4.7. Sturm-Liouville Theory

5. Distributions

5.1. The Notion of Generalized Functions
5.2. Test Functions
5.3. Distributions
5.4. Operations with Distributions
5.5. Convergence and Approximations to the Identity
5.6. Some Applications to Linear Differential Equations
5.7. Local Structure of $\mathcal{D}'$