

The Contents

Subject	Page
Dedication	I
Acknowledgment	II
Abstract	III
Abstract Arabic	IV
Introduction	V
The Contents	VI
Chapter 1: Weighted Sobolev Spaces with Zeros and Critical Points	1
Section(1.1): Pseudo differential Operators with Smooth Symbols	1
Section (1.2): Sobolev Orthogonal Polynomials	14
Chapter 2: Sobolev Embeddings and Constant Functions	26
Section (2.1): Concentration-Compactness Alternative for Fractional Sobolev Spaces	26
Section (2.2): Constant Functions Connections with Sobolev Spaces	44
Section(2.3): Composition and Products in Fractional Sobolev Spaces	54
Chapter 3: Convergence in the Mean and necessary Conditions	62
Section(3.1): Fourier Series in Orthogonal Polynomials	62
Section(3.2): Convergence of Fourier Series in Orthogonal Polynomials	68
Chapter 4: Zero Location and nth Root with Weierstrass' Theorem	73
Section (4.1): Asymptotics of Sobolev Orthogonal Polynomials	73
Section (4.2): Weighted Sobolev Spaces	80
Chapter 5: The Bourgain, Brezis, and Mironescu Theorem with Best constants	103
Section(5.1): Limiting Embeddings of Fractional Sobolev Spaces	103
Section(5.2): Sobolev inequalities for higher order fractional derivatives	109
Section (5.3): Fractional Sobolev spaces	116
Chapter 6: Relative asymptotics and Fourier series with $W^{1,p}$-convergence	148
Section (6.1): Orthogonal polynomials with a discrete Sobolev inner product	148
Section (6.2): Orthogonal polynomials with a non-discrete Gegenbauer-Sobolev inner product	158
Section (6.3): Fourier-Sobolev expansions	169
List of symbols	178
References	179