Contents

	Preface	vii
Chapter 1	Algebraic Foundations	1
1	Groups	2
2	Rings and Fields	11
3	Polynomials	18
4	Field Extensions	30
	Exercises	37
Chapter 2	Structure of Finite Fields	43
1	Characterization of Finite Fields	44
2	Roots of Irreducible Polynomials	47
3	Traces, Norms, and Bases	50
4	Roots of Unity and Cyclotomic Polynomials	59
5	Representation of Elements of Finite Fields	62
6	Wedderburn's Theorem	65
	Exercises	69
Chapter 3	Polynomials over Finite Fields	74
1	Order of Polynomials and Primitive Polynomials	75
2	Irreducible Polynomials	82

3	Construction of Irreducible Polynomials	87
4	Linearized Polynomials	98
5	Binomials and Trinomials	115
	Exercises	122
Chapter 4	Factorization of Polynomials	129
1	Factorization over Small Finite Fields	130
2	Factorization over Large Finite Fields	139
3	Calculation of Roots of Polynomials	150
	Exercises	159
Chapter 5	Exponential Sums	162
1	Characters	163
2	Gaussian Sums	168
	Exercises	181
Chapter 6	Linear Recurring Sequences	185
	Feedback Shift Registers, Periodicity Properties	186
2	Impulse Response Sequences, Characteristic Polynomial	193
	Generating Functions	202
4	The Minimal Polynomial	210
5	Families of Linear Recurring Sequences	215
6	Characterization of Linear Recurring Sequences	228
7	Distribution Properties of Linear Recurring Sequences	235
	Exercises	245
Chapter 7	Theoretical Applications of Finite Fields	251
1	Finite Geometries	252
2	Combinatorics	262
3	Linear Modular Systems	271
4	Pseudorandom Sequences	281
	Exercises	294
Chapter 8	Algebraic Coding Theory	299
1	Linear Codes	300
2	Cyclic Codes	311
3	Goppa Codes	325
	Exercises	332
Chapter 9	Cryptology	338
1	Background	339

2	Stream Ciphers	342
3	Discrete Logarithms	346
4	Further Cryptosystems	360
	Exercises	363
Chapter 10	Tables	367
1	Computation in Finite Fields	367
2	Tables of Irreducible Polynomials	377
	Bibliography	392
	List of Symbols	397
	Index	40: