

Contents

Chapter I. Basic Concepts	1
§ 1. Bilinear Forms and Inner Products	1
§ 2. Bilinear Forms over a Free Module	3
§ 3. Orthogonal Sums	4
§ 4. Witt's Theorem	7
§ 5. Tensor Products and Exterior Powers	9
§ 6. Split Inner Product Spaces	12
§ 7. The Witt Ring	14
Chapter II. Symmetric Inner Product Spaces over \mathbf{Z}	15
§ 1. Minkowski's Convex Body Theorem	15
§ 2. Inner Product Spaces of Rank ≤ 4 over \mathbf{Z}	18
§ 3. The Hasse-Minkowski Theorem and Meyer's Theorem	20
§ 4. Indefinite Spaces over \mathbf{Z}	22
§ 5. Spaces of Type II	24
§ 6. The Classification Problem for Positive Definite Spaces	26
§ 7. The Packing of Equal Balls in \mathbf{R}^n	29
§ 8. Sums of Two and Four Squares	39
§ 9. A Theorem of Siegel	41
Chapter III. Inner Product Spaces over a Field	56
§ 1. Anisotropic Inner Product Spaces	56
§ 2. Ordered Fields	59
§ 3. Prime Ideals in the Witt Ring	65
§ 4. Multiplicative Inner Product Spaces	72
§ 5. The Powers of the Fundamental Ideal	76
Chapter IV. Discrete Valuations and Dedekind Domains	84
§ 1. The Homomorphism $\partial_v: W(F) \rightarrow W(\bar{F})$	84
§ 2. Computation of $W(\mathbf{Q})$	87
§ 3. Dedekind Domains	91
§ 4. Number Fields	94

Chapter V. Some Examples	100
§ 1. Homology Theory of Manifolds	100
§ 2. Rings of Smooth Real Valued Functions	105
§ 3. The Discriminant of a Field Extension	107
Appendix 1. Quadratic Forms	110
Appendix 2. Hermitian Forms	114
Appendix 3. The Hasse-Minkowski Theorem	120
Appendix 4. Gauss Sums, the Signature mod 8, and Quadratic Reciprocity	127
Appendix 5. The Leech Lattice, and Other Lattices in Dimension 24	135
Chronological Table	140
References	141
Index	145
Special Notations	147