

Table of Contents

Chapter 1. Complex Tori

§ 1.1	The Definition of Complex Tori	1
§ 1.2	Hermitian Algebra	2
§ 1.3	The Invertible Sheaves on a Complex Torus	3
§ 1.4	The Structure of $\text{Pic}(V/L)$	5
§ 1.5	Translating Invertible Sheaves	7

Chapter 2. The Existence of Sections of Sheaves

§ 2.1	The Sections of Invertible Sheaves (Part I)	9
§ 2.2	The Sections of Invertible Sheaves (Part II)	10
§ 2.3	Abelian Varieties and Divisors	13
§ 2.4	Projective Embeddings of Abelian Varieties	15

Chapter 3. The Cohomology of Complex Tori

§ 3.1	The Cohomology of a Real Torus	19
§ 3.2	A Complex Torus as a Kähler Manifold	20
§ 3.3	The Proof of the Appel-Humbert Theorem	21
§ 3.4	A Vanishing Theorem for the Cohomology of Invertible Sheaves	23
§ 3.5	The Final Determination of the Cohomology of an Invertible Sheaf	25
§ 3.6	Examples	26

Chapter 4. Groups Acting on Complete Linear Systems

§ 4.1	Geometric Background	29
§ 4.2	Representations of the Theta Group	31
§ 4.3	The Hermitian Structure on $\Gamma(X, \mathcal{L})$	33
§ 4.4	The Isogeny Theorem up to a Constant	35

Chapter 5. Theta Functions

§ 5.1	Canonical Decompositions and Bases	37
§ 5.2	The Theta Function	38

VIII Table of Contents

§ 5.3 The Isogeny Theorem Absolutely 39
§ 5.4 The Classical Notation 40
§ 5.5 The Length of the Theta Functions 42

Chapter 6. The Algebra of the Theta Functions

§ 6.1 The Addition Formula 45
§ 6.2 Multiplication 47
§ 6.3 Some Bilinear Relations 49
§ 6.4 General Relations 51

Chapter 7. Moduli Spaces

§ 7.1 Complex Structures on a Symplectic Space 55
§ 7.2 Siegel Upper-half Space 58
§ 7.3 Families of Abelian Varieties and Moduli Spaces 62
§ 7.4 Families of Ample Sheaves on a Variable Abelian Variety 63
§ 7.5 Group Actions on the Families of Sheaves 66

Chapter 8. Modular Forms

§ 8.1 The Definition 69
§ 8.2 The Relationship Between $\pi'_*\mathcal{N}_A$ and H
in the Principally Polarized Case 70
§ 8.3 Generators of the Relevant Discrete Groups 72
§ 8.4 The Relationship Between $\pi'_*\mathcal{N}_A$ and H is General 76
§ 8.5 Projective Embedding of Some Moduli Spaces 77

Chapter 9. Mappings to Abelian Varieties

§ 9.1 Integration 81
§ 9.2 Complete Reducibility of Abelian Varieties 82
§ 9.3 The Characteristic Polynomial of an Endomorphism 83
§ 9.4 The Gauss Mapping 84

Chapter 10. The Linear System $|2D|$

§ 10.1 When $|D|$ Has No Fixed Components 87
§ 10.2 Projective Normality of $|2D|$ 88
§ 10.3 The Factorization Theorem 89
§ 10.4 The General Case 90
§ 10.5 Projective Normality of $|2D|$ on $X/\{\pm 1\}$ 92

Chapter 11. Abelian Varieties Occurring in Nature

§ 11.1 Hodge Structure 95
§ 11.2 The Moduli of Polarized Hodge Structure 97

§ 11.3 The Jacobian of a Riemann Surface 98
§ 11.4 Picard and Albanese Varieties for a Kähler Manifold 99
Informal Discussions of Immediate Sources 101
References 103
Subject Index 105