

Contents

Part A. Survey articles

1	A rapid introduction to Drinfeld modules, t-modules, and t-motives . . .	3
	<i>by W. Dale Brownawell, Matthew A. Papanikolas</i>	
1.1	Introduction	3
1.2	Exponential functions of algebraic groups	3
1.3	Drinfeld modules	5
1.4	t -Modules	11
1.5	t -Motives	19
	References	28
2	Pink’s theory of Hodge structures and the Hodge conjecture over function fields	31
	<i>by Urs Hartl, Ann-Kristin Juschka</i>	
2.1	Introduction	31
2.2	Hodge–Pink structures	43
2.3	Mixed A -motives	49
2.4	Mixed dual A -motives	73
2.5	Anderson A -modules	94
2.6	Applications	155
2.7	σ -Bundles	158
	References	177
3	Local shtukas, Hodge–Pink structures and Galois representations . . .	183
	<i>by Urs Hartl, Wansu Kim</i>	
3.1	Introduction	183
3.2	Local shtukas	187
3.3	Divisible local Anderson modules	191
3.4	Tate modules	195
3.5	Hodge–Pink structures	209
3.6	Admissibility and weak admissibility	222
3.7	Torsion local shtukas and torsion Galois representations	230
3.8	Deformation theory of Galois representations	245
	References	255
4	Frobenius difference equations and difference Galois groups	261
	<i>by Chieh-Yu Chang</i>	
4.1	Introduction	261
4.2	t -Motivic transcendence theory	262
4.3	Carlitz polylogarithms and special ζ -values	268

4.4	Special values of geometric and arithmetic Γ -functions	274
4.5	Periods and logarithms of Drinfeld modules	284
4.6	Transcendence problems with varying constant fields	289
	References	294
5	An introduction to Mahler's method for transcendence and algebraic independence	297
	<i>by Federico Pellarin</i>	
5.1	Introduction	297
5.2	Transcendence theory over the base field \mathbb{Q}	299
5.3	Transcendence theory in positive characteristic	306
5.4	Algebraic independence	318
	References	346
6	Automata methods in transcendence	351
	<i>by Dinesh S. Thakur</i>	
6.1	Introduction	351
6.2	Automata: implications, equivalences: definitions and statements	352
6.3	Sketches of proofs	359
6.4	Applications to function field arithmetic	362
6.5	Comparison with other tools	364
6.6	Refined transcendence classification based on strength of computers	366
6.7	Beyond function field real numbers	367
6.8	Strong characteristic dependence for algebraicity and real numbers	368
	References	370
 Part B. Research articles		
7	Iwasawa theory over function fields	375
	<i>by Andrea Bandini, Francesc Bars, and Ignazio Longhi</i>	
7.1	Introduction	375
7.2	Control theorems for abelian varieties	378
7.3	Λ -Modules and Fitting ideals	386
7.4	Modular abelian varieties of GL_2 -type	389
7.5	Class groups	392
7.6	Cyclotomy by the Carlitz module	404
	References	413
8	1-t-Motifs	417
	<i>by Lenny Taelman</i>	
8.1	Introduction & statement of the main results	417
8.2	Duality for torsion modules over $k[[z]]$	419
8.3	Effective t -motifs and abelian t -modules	420

8.4	Algebraic theory of $1-t$ -motifs	425
8.5	Uniformization and Hodge structures	429
8.6	Transcendental theory of $1-t$ -motifs	434
	References	438
9	Multizeta in function field arithmetic	441
	<i>by Dinesh S. Thakur</i>	
9.1	Introduction	441
9.2	Multizeta values for function fields: Definitions	442
9.3	First kind of relations between multizeta	443
9.4	Second kind of relations between multizeta	445
9.5	Period interpretation and motivic aspects	446
9.6	Updates added on 23 August 2011	448
9.7	Updates added on 5 February 2013	449
9.8	Updates added on 27 April 2015	449
	References	450
	Index	455