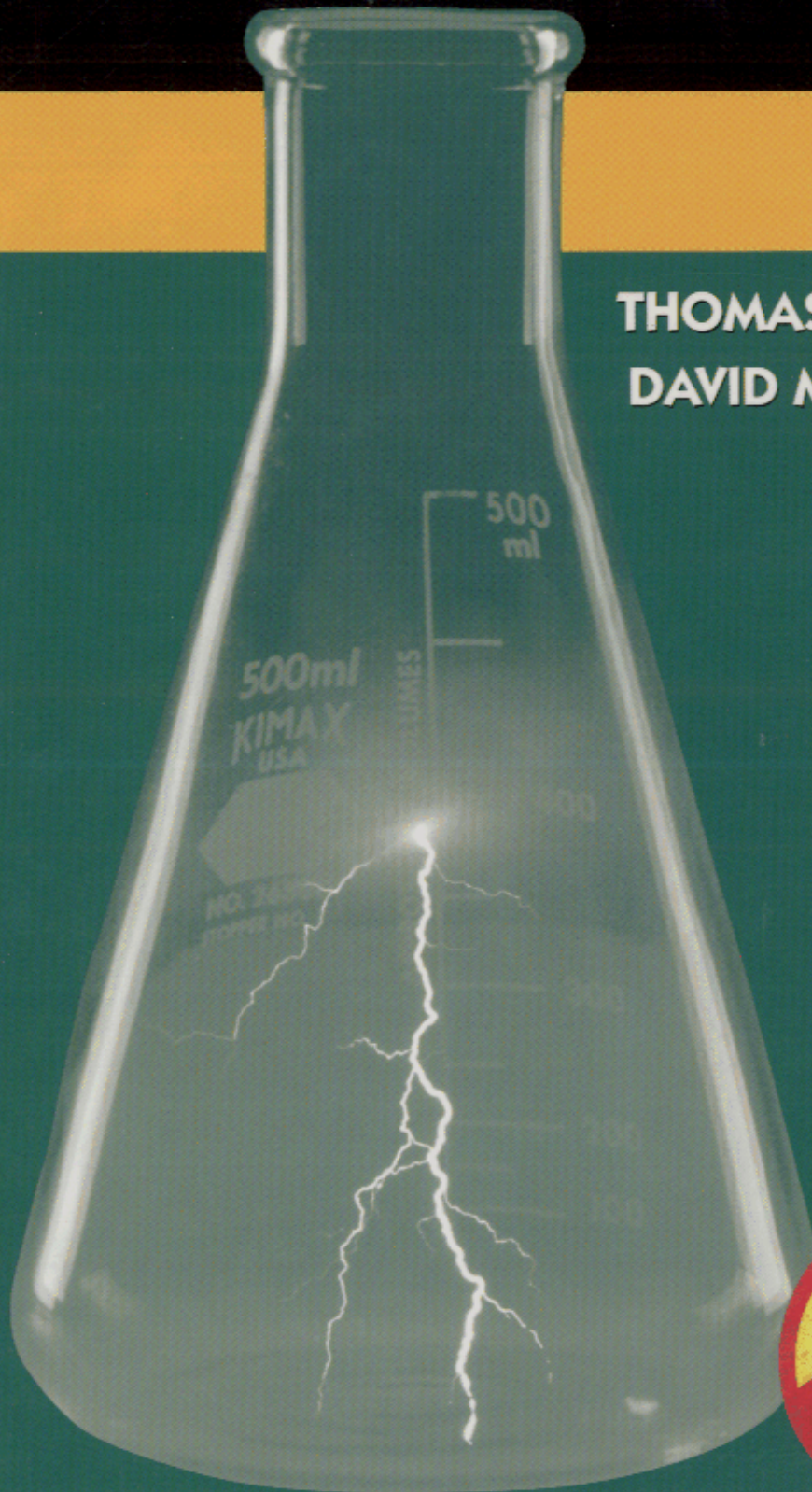


The Science of Electronics

Digital

THOMAS L. FLOYD
DAVID M. BUCHLA



CONTENTS

CHAPTER 1

Digital Quantities and Functions	2
1-1 Analog and Digital Quantities	4
1-2 Binary Numbers	7
1-3 Hexadecimal and Octal Numbers	10
1-4 Number Systems on the Calculator	14
1-5 Logic Levels and Digital Waveforms	17
1-6 Elements of a Digital System	21
1-7 Introduction to Instruments	23

CHAPTER 2

Logic Gates: AND, OR, and Inverter	38
2-1 Basic Logic Functions	40
2-2 The AND Gate	42
2-3 The OR Gate	45
2-4 The Inverter	48
2-5 Boolean Algebra Applied to AND, OR, and NOT	50
2-6 Integrated Circuits	55
2-7 Troubleshooting	58

CHAPTER 3

Logic Gates: NAND and NOR	68
3-1 The NAND Gate	70
3-2 The NOR Gate	72
3-3 Boolean Algebra Applied to NAND and NOR	75
3-4 Integrated Circuits	78
3-5 Troubleshooting	82

CHAPTER 4

Logic Gate Combinations	90
4-1 Exclusive-OR (XOR) Gate	92
4-2 Exclusive-NOR (XNOR) Gate	95
4-3 AND-OR/AND-OR-Invert Logic	97
4-4 Boolean Algebra Applied to Gate Combinations	101
4-5 Standard Forms of Combinational Logic	105
4-6 Karnaugh Maps	110
4-7 Integrated Circuits	114
4-8 Troubleshooting	116

CHAPTER 5

Arithmetic Logic and Processes	126
5-1 Binary Adders	128
5-2 The Parallel Binary Adder	132
5-3 1's and 2's Complements	134
5-4 Binary Subtraction	136
5-5 Binary Multiplication and Division	137
5-6 Floating-Point Numbers	140
5-7 The Magnitude Comparator	142
5-8 Integrated Circuits	145
5-9 Troubleshooting	147

CHAPTER 6

Binary Codes and Data Logic	158
6-1 Binary Codes	160
6-2 Decoders	164
6-3 Encoders	168
6-4 Data Selectors	171
6-5 Integrated Circuits	176
6-6 Troubleshooting	179

CHAPTER 7

Latches, Flip-Flops, and Timers	192
7-1 The Set-Reset (S-R) Latch	194
7-2 Gated Latches	197
7-3 The D Flip-Flop	199
7-4 The J-K Flip-Flop	202
7-5 The One-Shot	205
7-6 The 555 Timer	207
7-7 Integrated Circuits	209
7-8 Troubleshooting	212

CHAPTER 8

Counters	224
8-1 Counting with Binary Numbers	226
8-2 The Binary Counter	227
8-3 The Decade Counter	233
8-4 Counter Decoding	237
8-5 A Counter Application	239
8-6 Integrated Circuits	242
8-7 Troubleshooting	244

CONTENTS

CHAPTER 9

Shift Registers256

- 9-1 Basic Shift Register Functions258
- 9-2 Serial Input Shift Registers259
- 9-3 Parallel Input Shift Registers265
- 9-4 Bidirectional Shift Registers269
- 9-5 Shift Register Counters270
- 9-6 Integrated Circuits274
- 9-7 Applications278
- 9-8 Troubleshooting283

CHAPTER 10

Programmable Logic296

- 10-1 Programmable Logic Devices (PLDs)298
- 10-1 Programmable Array Logic (PAL)301
- 10-3 Generic Array Logic (GAL)306
- 10-4 CPLDs and FPGAs309
- 10-5 PLD Programming318
- 10-6 Introduction to VHDL323

CHAPTER 11

Computer Basics342

- 11-1 The Basic Computer System344
- 11-2 Microprocessors349

- 11-3 Semiconductor Memory Organization ..352

- 11-4 RAM355

- 11-5 ROM364

- 11-6 Mass Storage Devices367

- 11-7 Computer Programming373

CHAPTER 12

Digital Signal Processing386

- 12-1 Digital Signal Processing Basics388

- 12-2 Converting Analog Signals to Digital389

- 12-3 Analog-to-Digital Conversion Methods ..395

- 12-4 The Digital Signal Processor (DSP)405

- 12-5 Digital-to-Analog Conversion Methods ..411

Appendix A Summary of Boolean

Algebra428

Appendix B Lab Manual Figures434

Answers to Odd-Numbered Questions ..436

Answers to Odd-Numbered Problems ...440

Glossary464

Index469