

DIGITAL SYSTEMS FUNDAMENTALS

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To my Family- Ganga, Geethika and Charvi and my Parents for their sacrifice, Patience, understanding and support

PWCP

To my Family – Bee Wad, Xin Yun , Xin Yan and Xin Lin who provide inspiration , guidance and unwavering support.

LSH

To those poor families who are fighting with hunger in whole world

AKS

To my wife-Gusti Fitriani,my two sons Ardhi and Rayhan. The source of my inspiration

MS

FORWARD

P. W. Chandana Prasad, Lau Siong Hoe, Dr. Ashutosh Kumar Singh and Muhammad Suryanata are highly experienced lecturers on digital systems at Multimedia University. It is my great honor and privilege to be able to write this forward, and to bring you this highly educational book based on their extensive experience across academic, research institutions and the industry.

Packed with illustration, diagrams and more, this user-friendly and highly readable introduction to digital fundamentals presents material in a manner that balances both theory and practice. It introduces the basic concepts of digital logic from number systems and Boolean representation through the basic logic gates and simple combinational logic circuits to encoders / decoders, multiplexers and others. It supports clear, accurate explanations of theory with superior exercises, examples, and visual aids. The great strength of the book is in its superb pedagogical style. The book consistently does an excellent job of explaining difficult concepts clearly. It includes only the mathematics readers need to understand certain concepts. This book is for an introduction to digital systems in two- and four-year programs in technology, engineering, computer science, and information technology. While a background in basic electronics is helpful, the majority of the material requires no electronics training. I hope this book will be informative and helpful.

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PREFACE

The digital technology has been developed last five decades and received a dramatic impulse due to rapid growth of digital communication, signal processing, entertainment etc. Today, digital technology is applied in a wide range of areas in addition to computer therefore in IT. digital technology has developed from the vacuum tube circuit to integrated circuits and microprocessors.

This book is a comprehensive study of the principles and techniques of digital systems, which covers the analysis, design and specification of digital circuits. Here we covers the basic knowledge of digital systems which are necessary for the students of engineering, computer science and information technology. Although a background of electronics is helpful but the given material do not need electronics training because the portions which utilized electronic concepts can be skipped without adversely affecting the comprehension of the logic principles. However this complete book can be cover in a one-semester course.

Chapter one is dedicated to the advantage of digital systems over analog systems in brief and different type of number systems, which is used in digital technology in detail. The second chapter explains the basic building block i.e. logic gates from which all other logic circuits and digital systems are constructed. The Boolean laws and rules are also discussed in this chapter. Simplifications of combinational logic circuit using these laws, rules and K–maps are covered in Chapter 3. Chapter 4 deals the sequential circuits in which the output does not depend on the present output but also depend on the past output. In Chapter 5 we discuss the arithmetic operation using digital circuit known as arithmetic circuits. Chapter 6 is concerning the MSI logic circuits such as decoders, encoders, comparators, multiplexers and demultiplexers. Counters and registers for storage the binary data is discussed in Chapter 7. Chapter 8 presents the important IC logic families of digital circuits. Since the entire practical signal is analog in nature then analog to digital and digital to analog interfacing are explained in Chapter 9. Last chapter is devoted to a study of most commonly used types of memory devices and systems.

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CONTENTS

<i>Foreword</i>	i
<i>Preface</i>	ii
<i>Acknowledgements</i>	iii
1.0 INTRODUCTION AND NUMBER SYSTEMS	1
1.1 Digital Signals and Analog Signals	2
1.1.1 Advantages of Digital Systems over Analog Systems	3
1.1.2 Analog Systems	3
1.1.3 Drawbacks in Digital Systems	3
1.2 Decimal Number System	4
1.3 Binary Number System	5
1.3.1 Binary-to-Decimal Conversion	6
1.3.2 Decimal-to-Binary Conversion	7
1.3.3 Binary Addition	8
1.3.4 Binary Subtraction	9
1.3.5 Binary Division	10
1.3.6 Binary Multiplication	10
1.3.7 Signed Binary Numbers	11
1.4 Octal Number System	11
1.4.1 Octal-to-Decimal Conversion	11
1.4.2 Decimal-to-Octal Conversion	12
1.4.3 Octal-to-Binary Conversion	12
1.4.4 Binary-to-Octal Conversion	13
1.4.5 Octal Addition	14
1.5 Hexadecimal Number System	14
1.5.1 Hexadecimal-to-Decimal Conversion	15
1.5.2 Decimal-to-Hexadecimal Conversion	15
1.5.3 Hexadecimal-to-Binary Conversion	16

1.5.4	Binary-to-Hexadecimal Conversion	16
1.5.5	Hexadecimal Addition	17
1.5.6	Hexadecimal Subtraction	17
1.6	Binary Coded Decimal Code (BCD)	18
1.6.2	Binary-to-BCD Conversion	19
1.6.3	BCD-to-Binary Conversion	20
1.7	Excess-3 Code	21
1.7.1	Decimal-to-XS3 Conversion	21
1.7.2	XS3-to-BCD Conversion	22
1.8	Gray Code	22
1.8.1	Binary-to-Gray Code Conversion	22
1.8.2	Gray Code-to-Binary Conversion	23
1.9	ASCII Code	24
	<i>Exercises</i>	25

2.0 LOGIC ELEMENTS 29

2.1	The AND Gate	30
2.1.1	Logical Operation for the AND Gate	30
2.1.2	Boolean Expression for the AND Gate	31
2.1.3	Timing Diagram for the AND Gate	32
2.1.4	Commercial Integrated Circuit AND Gate	33
2.2	The OR Gate	38
2.2.1	Logical Operation for the OR Gate	38
2.2.2	Boolean Expression for the OR Gate	39
2.2.3	Timing Diagram for the OR Gate	40
2.2.4	Commercial Integrated Circuit OR Gate	41
2.3	The NOT Gate	45
2.3.1	Logical Operation for the NOT Gate	45
2.3.2	Boolean Expression for the NOT Gate	46
2.3.3	Commercial Integrated Circuit NOT Gate	48
2.4	The NAND Gate	49
2.4.1	Logical Operation for the NAND Gate	49
2.4.2	Boolean Expression for the NAND Gate	50
2.4.3	Commercial Integrated Circuit NAND Gate	50
2.5	The NOR Gate	54
2.5.1	Logical Operation for the NOR Gate	54

2.5.2 Boolean Expression for the NOR Gate	55
2.5.3 Commercial Integrated Circuit NOR Gate	55
2.6 Logic Circuit Output	59
2.7 Implementing Circuit from Boolean Expression	61
2.8 Boolean Theorems	63
2.8.1 Basic Rules of Boolean Algebra	63
2.9 Demorgan's Theorems	75
2.9.1 First Theorem	75
2.9.2 Second Theorem	76
2.10 Boolean Functions Using Universal Gates	78
<i>Exercises</i>	79

3.0 COMBINATIONAL LOGIC CIRCUIT 84

3.1 Representation of Boolean Expressions	85
3.1.1 Sum of Products	85
3.1.2 Product of Sums	89
3.2 Simplifying Logic Circuits	93
3.3 Simplification Using Boolean Algebra	93
3.4 Design of Combinational Circuit	96
3.5 Karnaugh Map Simplification	99
3.5.1 Two Variable <i>K</i> -Map	100
3.5.2 Three Variable <i>K</i> -Map	101
3.5.3 Four Variable <i>K</i> -Map	102
3.5.4 Looping	104
3.5.5 Karnaugh Map POS Minimisation	111
3.5.6 Don't-Cares on <i>K</i> -Map	112
3.6 Exclusive OR and Exclusive NOR Circuit	114
3.6.1 Exclusive-OR	114
3.6.2 Exclusive-NOR	116
3.7 Parity Generators and Checkers	118
3.7.1 Parity Generator	118
3.7.2 Parity Checker	119
<i>Exercises</i>	120

4.0	SEQUENTIAL LOGIC	124
4.1	NAND Gate Latch	125
4.2	NOR Gate Latch	127
4.3	RS Flip-Flop	129
	4.3.1 Clocked RS Flip-Flop	130
	4.3.2 Master-Slave RS Flip-Flop	136
	4.3.3 Clocked RS Flip-Flop with Asynchronous Inputs	139
4.4	JK Flip-Flop	141
	4.4.1 Master-Slave JK Flip-Flop	145
	4.4.2 Clocked JK Flip-Flop with Asynchronous Inputs	148
4.5	D Flip-Flop	150
4.6	T Flip-Flop	152
4.7	Flip-Flop Synchronisation	153
4.8	Multivibrators	154
	4.8.1 Astable Multivibrator	155
	4.8.2 Monostable Multivibrators	157
	<i>Exercises</i>	160
5.0	ARITHMETIC CIRCUITS	162
5.1	Signed Number	163
	5.1.1 1's Complement Form	164
	5.1.2 2's Complement Form	165
	5.1.3 Signed Number Representation Using 2's Complement	165
	5.1.4 Range of Signed Numbers	167
	5.1.5 Negation	168
5.2	2's-Complement System Arithmetic Operations	169
	5.2.1 Addition	169
	5.2.2 Subtraction	172
	5.2.3 Multiplication	174
	5.2.4 Division	177
5.3	Adders	179
	5.3.1 Half-Adder	179
	5.3.2 Full-Adder	181
5.4	Subtractors	183
	5.4.1 Half-Subtractor	183

5.4.2	Full–Subtractor	185
5.5	Parallel Adder	187
5.5.1	Four Bit Parallel Adders	188
5.6	Parallel Subtractor	191
5.6.1	Four Bit Parallel Subtractor	192
	<i>Exercises</i>	196
6.0	MSI LOGIC CIRCUIT	198
6.1	Decoders	199
6.1.1	The 3–Bit Decoder	200
6.1.2	The 4–Bit Decoder	202
6.2	Encoder	205
6.2.1	The Decimal-to-BCD Encoder	207
6.2.2	The Octal–to–Binary Encoder	210
6.3	7–Segment Drivers	213
6.3.1	The BCD–to–Seven–Segment Decoder/Driver	214
6.4	Multiplexer	216
6.4.1	MSI Quad Two–Input Multiplexer	218
6.4.2	MSI 8–Input Multiplexer	218
6.5	Demultiplexer	221
6.5.1	1–Line–To–8–Line Demultiplexer(1:8 Dmux)	222
6.5.2	1–of–16 Demultiplexer (1:16 Dmux)	223
6.6	Comparators	226
6.7	Code Converters	229
	<i>Exercises</i>	232
7.0	COUNTERS AND REGISTER	235
7.1	Asynchronous Counters	236
7.2	Asynchronous Counters with Modulo Numbers	242
7.3	Synchronous (Parallel) Counters	245
7.4	Synchronous Counters Design	247
7.5	Shift Registers	258
7.5.1	Serial Input – Serial Output	259
7.5.2	Parallel Input – Serial Output	261

7.5.3 Parallel Input – Parallel Output	263
7.5.4 Serial Input – Parallel Output	264
<i>Exercises</i>	267

8.0 IC LOGIC FAMILIES 269

8.1 Bipolar And Unipolar Digital IC's	270
8.2 Transistor Switch	270
8.3 Resistor Transistor Logic (RTL)	272
8.4 Diode–Transistor Logic (DTL)	272
8.5 TTL Circuits	273
8.6 TTL Voltage and Current Levels	274
8.7 Loading and Fan–Out	275
8.8 Noise Margin	276
8.9 Power Dissipation and Average Current	277
8.10 Propagation Delays	278
8.11 Speed–Power Product	279
8.12 Commercial TTL–IC	279
8.13 Logic Gates Using TTL	280
8.13.1 Inverter	280
8.13.2 NAND Gate	281
8.13.3 NOR Gate	283
8.14 TTL Series	284
8.15 Types Of Output Circuitry	285
8.15.1 Totem–Pole Output	285
8.15.2 Tri-State Output	286
8.15.3 Open Collector Output	287
8.16 CMOS Logic	288
8.17 CMOS Noise Margin and Logic Levels	289
8.18 Commercial CMOS–IC	290
8.19 MOSFET	290
8.20 Logic Gates Using CMOS	291
8.20.1 Inverter	291
8.20.2 NAND Gate	293
8.20.3 NOR Gate	294
8.21 Emitter-Coupled Logic (ECL)	296
<i>Exercise</i>	297

9.0	MEMORY DEVICES	299
9.1	Memory Definitions	300
9.2	Memory Operation	302
9.2.1	Memory Address	303
9.2.2	Read / Write Inputs	304
9.2.3	Memory Enable	305
9.3	CPU–Memory Connection	305
9.4	Read Only Memory (ROM)	307
9.4.1	ROM Block Diagram	307
9.4.2	Types of ROMs	309
9.5	Random Access Memory (RAM)	312
9.5.1	RAM Block Diagram	312
9.5.2	Types of RAM	314
	<i>Exercises</i>	320
	Index	322

