

Mike Holt's Master Basic Exam Prep Video Program

Table of Contents

This document includes the Table of Contents from each book that is included in your library. Click on the title to view details of the contents of that book.



Title	page #
Electrical Exam Preparation	2
Master Electrician Simulated Exam.....	6

2023
NEC®



Mike Holt's 2023 Electrical Exam Preparation

TABLE OF CONTENTS

About This Textbook.....	ix
Passing Your Exam.....	xiii
Additional Products to Help You Learn.....	xix
How to Use the <i>National Electrical Code</i>	1

THEORY

MODULE I—ELECTRICAL FUNDAMENTALS..... 7

Unit 10—Basic Math	9
10.1 Introduction	9
10.2 Whole Numbers.....	9
10.3 Fractional Numbers	9
10.4 Decimal Numbers.....	9
10.5 Percentages.....	10
10.6 Parentheses.....	11
10.7 Squaring a Number	11
10.8 Square Root.....	11
10.9 Kilo.....	11
10.10 Rounding	12
10.11 Surface Area of a Rectangle or Square	12
10.12 Surface Area of a Circle.....	13
10.13 Volume.....	14
10.14 Reciprocal	15
10.15 Testing Your Answer	15
Unit 10—Review Questions	16
Unit 12—Ohm's Law	19
12.1 Introduction	19
12.2 The Electrical Circuit.....	19
12.3 Electromotive Force (Pressure).....	19
12.4 Circuit Resistance	20
12.5 Circuit Intensity.....	21
12.6 Ohm's Law	21
Unit 12—Review Questions	23

Unit 13—Watt's Law	25
13.1 Introduction	25
13.2 Watt's Law	25
13.3 Power Formula Circle.....	26
13.4 Power Changes with the Square of the Voltage.....	27
Unit 13—Review Questions	28
Unit 14—Series Circuits	31
14.1 Introduction	31
14.2 Series Circuits.....	31
14.3 Understanding Series Circuits	31
14.4 Series Circuit Summary.....	34
14.5 Series-Connected Power Supplies	35
14.6 Applications of Series Circuits	36
Unit 14—Review Questions	37
Unit 15—Parallel Circuits	39
15.1 Introduction	39
15.2 Understanding Parallel Circuits	39
15.3 Parallel Circuit Resistance Calculations	41
15.4 Parallel Circuit Summary.....	44
15.5 Parallel-Connected Power Supplies	44
15.6 Practical Uses of Parallel Circuits.....	45
Unit 15—Review Questions	47
Unit 16—Series-Parallel Circuits	51
16.1 Introduction	51
16.2 Understanding Series-Parallel Circuits	51
16.3 Calculating Resistance in Series-Parallel Circuits	51
Unit 16—Review Questions	53
Unit 17—Alternating Current Fundamentals	55
17.1 Introduction	55
17.2 How Alternating Current is Produced	55
17.3 Waveforms	56
17.4 Frequency	58
17.5 In-Phase Waveforms	59
17.6 Out-of-Phase Waveforms	59
17.7 Alternating-Current Waveform Values	60
Unit 17—Review Questions	63

Unit 20—True Power, Power Factor, and Apparent Power	67
20.1 Introduction	67
20.2 True Power	67
20.3 Power Losses of Wires	67
20.4 Power Losses at Terminals	68
20.5 Equipment Efficiency	69
20.6 Cost of Power	69
20.7 Power Factor	70
20.8 Apparent Power	72
20.9 Apparent Power versus True Power	73
Unit 20—Review Questions	74
Unit 21—Motors	77
21.1 Introduction	77
21.3 Motor Horsepower Rating	77
21.5 Motor Nameplate Amperes	78
21.7 Reversing the Rotation of Alternating-Current Motors	79
21.8 Alternating-Current Motor Types	80
Unit 21—Review Questions	81
Unit 22—Generators	83
22.1 Introduction	83
22.4 Generator Output Current	83
22.5 Single-Phase and Three-Phase Generator Voltages	84
Unit 22—Review Questions	85
Unit 23—Relays	87
23.1 Introduction	87
23.2 How Relays Operate	87
23.3 Relay Contacts	88
Unit 23—Review Questions	89
Unit 24—Transformers	91
24.1 Introduction	91
24.6 Transformer Turns Ratios	91
24.8 Autotransformers	93
24.11 Transformer Current Rating	93
Unit 24—Review Questions	97
Unit 25—Overcurrent Protection	101
25.1 Introduction	101
25.6 Available Short-Circuit Current	101
25.7 Overcurrent Protective Devices, Interrupting Rating	103
Unit 25—Review Questions	104

Unit 29—The Formula Wheel	105
29.1 Introduction	105
29.2 Formula Wheel Quadrants	105
29.3 Using the Formula Wheel	106
Unit 29—Review Questions	108
Module I—Electrical Fundamentals—Practice Exam	111
Module I—Electrical Fundamentals Section Reference Index	117

CODE

MODULE II—NEC REVIEW QUESTIONS	119
<i>NEC Article 90—Introduction to the National Electrical Code Review Questions</i>	121
<i>NEC Chapter 1—General Rules Review Questions</i>	123
<i>NEC Chapter 2—Wiring and Protection Review Questions</i>	130
<i>NEC Chapter 3—Wiring Methods and Materials Review Questions</i>	155
<i>NEC Chapter 4—Equipment for General Use Review Questions</i>	172
<i>NEC Chapter 5—Special Occupancies Review Questions</i>	185
<i>NEC Chapter 6—Special Equipment Review Questions</i>	192
<i>NEC Chapter 7—Special Conditions Review Questions</i>	199
<i>NEC Chapter 8—Communications Systems Review Questions</i>	219
Module II—NEC Review Questions—Practice Exam	225
Module II—NEC Review Questions Code Rule Index	235

CALCULATIONS

MODULE III—NEC CALCULATIONS	239
Unit 1—Raceway Calculations	241
1.1 Conductor Cross-Sectional Area—Chapter 9, Tables 5 and 8	241
1.2 Raceway Properties	245
1.3 Sizing Raceways, Conductors all the Same Size—Annex C	247
1.4 Raceways Sizing with Different Size Conductors	251
1.5 Multiconductor and Optical Fiber Cables—Chapter 9, Note (5) and Note (9)	253
1.6 Wireways and Cable Tray Systems	254
1.7 Tips for Raceway Calculations	258
Unit 1—Review Questions	259

Unit 2—Box Calculations	265
Part A—Outlet Box Sizing	265
Introduction.....	265
2.1 Box Sizing—Conductors All the Same Size [Table 314.16(A)].....	266
2.2 Outlet Box Fill Calculations [314.16(B)].....	267
2.3 Outlet Box Sizing, Examples [314.16(B)].....	271
2.4 Tips for Outlet Box Sizing	272
Part B—Pull and Junction Boxes	273
Introduction.....	273
2.5 Pull/Junction Box Sizing Requirements	273
2.6 How to Size Pull/Junction Boxes.....	275
2.7 Pull Box Sizing Examples.....	275
2.8 Tips for Pull Box Sizing	277
Unit 2—Review Questions	279
Unit 3—Conductor Sizing and Protection Calculations	283
Part A—Conductor Insulation, Terminals, and Overcurrent Protection	283
Introduction.....	283
3.1 Conductor Insulation [Table 310.4(1)]	283
3.2 Conductor Sizes	284
3.3 Conductor Size—Equipment Terminal Rating [110.14(C)].....	285
3.4 Overcurrent Protection of Conductors [240.4]	288
Part B—Conductor Ampacity and Protection	290
Introduction.....	290
3.5 Conductor Ampacity Table [310.15(A)].....	290
3.6 Conductor Ampacity Correction [310.15(B)(1)]	290
3.7 Conductor Ampacity Adjustment [310.15(C)(1)].....	292
3.8 Ampacity Correction and Adjustment [310.15].....	294
3.9 Neutral Current-Carrying Conductor [310.15(E)]	295
3.10 Branch Circuit Conductor Sizing [210.19(A)(1)]	297
3.11 Branch Circuit Conductor Sizing—Loads	298
3.12 Branch Circuit Overcurrent Protection Sizing [210.20(A)].....	299
3.13 Feeder Conductor Sizing [215.2(A)(1)].....	300
3.14 Feeder Neutral Conductor Size [215.2(A)(1) Ex 3].....	301
3.15 Feeder Overcurrent Protection Sizing [215.3]	302
3.16 Feeder Tap Rules [240.21(B)]	302
Unit 3—Review Questions	307
Unit 4—Motor, Air-Conditioning, and Transformer Calculations	315
Part A—Motor Calculations	315
Introduction.....	315
4.1 Motor Full-Load Current (FLC)	315
4.2 Motor Full-Load Current and Motor Nameplate Current Rating [430.6(A)].....	317
4.3 Branch-Circuit Conductor Sizing Continuous Duty Application [430.22].....	318
4.4 Branch-Circuit Conductor Sizing for Duty-Cycle Application [430.22(E)].....	321
4.5 Overcurrent Protection	322
4.6 Motor Overload Protection	323
4.7 Branch-Circuit Short-Circuit and Ground-Fault Protection [430.52].....	327
4.8 Branch-Circuit Summary	331
4.9 Motor Circuit Equipment Grounding Conductor Size [250.122(D)(1)].....	332
4.10 Feeder Conductor Sizing [430.24]	332
4.11 Feeder Short-Circuit and Ground-Fault Protection [430.62(A)]	334
Part B—Air-Conditioning Calculations	336
Introduction.....	336
4.12 Air-Conditioning Equipment Nameplate [440.4(B)].....	336
4.13 Air-Conditioning Equipment, Short-Circuit and Ground-Fault Protection [440.22].....	337
4.14 Air-Conditioning Equipment, Conductor Ampacity [440.33]	338
Part C—Transformers	339
Introduction.....	339
4.15 Transformer Primary Only Overcurrent Protection [450.3(B)]	339
4.16 Transformer Secondary Conductor Sizing [240.21(C)]	342
Unit 4—Review Questions	345
Unit 5—Voltage-Drop Calculations	351
Part A—Conductor Resistance Calculations	351
Introduction.....	351
5.1 Conductor Cross-Sectional Area in Circular Mills [Chapter 9, Table 8].....	351
5.2 Conductor Resistance	353
5.3 Conductor Resistance [Chapter 9, Table 8]	354
Part B—Voltage-Drop Calculations	356
Introduction.....	356
5.4 Conductors' Voltage Drop—Ohm's Law Method	356
5.5 Single-Phase Circuit Voltage Drop—Formula Method.....	357
5.6 Three-Phase Circuit Voltage Drop—Formula Method	359
5.7 Sizing Conductor Single-Phase Circuit Voltage Drop—Formula Method	360
5.8 Sizing Conductor Three-Phase Circuit Voltage Drop—Formula Method	362
Unit 5—Review Questions	365

Unit 6—Dwelling Unit Calculations	369
Part A—Optional Method Load Calculations [Article 220, Part IV]	369
Introduction.....	369
6.1 Dwelling Unit Optional Load Calculations [220.82]	369
6.2 Dwelling Unit Optional Load Calculation [220.82], Example	371
Part B—Standard Method Load Calculations [Article 220, Part III]	372
Introduction.....	372
6.3 Dwelling Unit Standard Load Calculation	372
6.4 General Lighting and General-Use Receptacle Demand Load [220.41 and Table 220.45]	372
6.5 Fixed Appliance Demand Load [220.53]	375
6.6 Dryer Demand Load [220.54]	376
6.8 Electric Cooking Equipment Demand Load [220.55]	376
6.10 Electric Vehicle [220.57]	378
6.11 Air-Conditioning Versus Heating [220.50, 220.51, and 220.60]	379
6.12 Service Conductor Size [Table 310.12(A)]	380
6.13 Standard Method Load Calculations, Example [Article 220, Part III]	381
6.14 Number of General Lighting and General-Purpose Receptacle Circuits [210.11(A)]	382
Part C—Neutral Load Calculations	383
Introduction.....	383
6.15 Neutral Calculations—Dryers and Ranges [220.61]	383
6.16 Service Neutral Calculation [220.61]	384
Unit 6—Review Questions	387
Module III—NEC Calculations Practice Exam	393
 MODULE IV—ADVANCED NEC CALCULATIONS	401
Unit 7—Multifamily Dwelling Calculations	403
Part A—Optional Method Load Calculations [Article 220, Part IV]	403
Introduction.....	403
7.1 Multifamily Dwelling Optional Load Calculations [220.84]	403
7.2 Multifamily Dwelling Optional Method, Example [220.84]	404
Part B—Standard Method Load Calculations [Article 220, Part III]	405
Introduction.....	405
7.3 General Lighting and General-Use Receptacle Demand Load [220.41 and 220.45]	406
7.4 Appliance Demand Load [220.53]	407
7.5 Dryer Demand Load [220.54]	408
7.6 Single-Phase Dryers on Three-Phase Service [220.54]	410
7.7 Electric Cooking Equipment [220.55]	412
7.8 Single-Phase Ranges on Three-Phase Service [220.55]	414
7.9 Air-Conditioning and Heating Demand Load	416
7.10 Service Conductor Sizing [Table 310.16]	417
7.11 Multifamily Dwelling Calculations—Standard Method, Examples	418
7.12 Two-Family (Duplex) Dwelling Units Load Calculations [220.85]	420
Part C—Neutral Load Calculations	423
Introduction.....	423
7.13 Neutral Demand Load—Dryers and Ranges [220.61]	423
7.14 Service Neutral Demand Load [220.61(B)]	424
Unit 7—Review Questions	427
 Unit 8—Commercial Calculations	435
Part A—General Commercial Demand Loads	435
Introduction.....	435
8.1 General Lighting Load [Table 220.42(A)]	435
8.2 General Lighting Load, Examples [Table 220.42(A)]	436
8.3 General Lighting Load Demand Factors [Table 220.45]	437
8.4 Number of General Lighting Circuits	438
8.5 Sign Circuit [220.14(F)]	439
8.6 Multioutlet Assemblies [220.14(H)]	439
8.7 Receptacle Demand Load [220.14(I) and 220.47]	440
8.8 Air-Conditioning versus Heating Demand Load [220.60]	442
Part B—Office, Mobile Home, Kitchen, Restaurants, and School Examples	442
Introduction.....	442
8.9 Office Building, Example	443
8.10 Mobile Home Parks [550.31]	444
8.11 Kitchen Equipment and Restaurants	444
8.12 School Optional Method Load Calculations [220.86]	447
Part C—Welder Calculations	448
Introduction.....	448
8.13 Arc Welders	448
8.14 Resistance Welders	450
Part D—Light Industrial Calculations	452
Introduction.....	452
8.15 Light Industrial Calculations	452
Unit 8—Review Questions	455
Module IV—Advanced NEC Calculations—Practice Exam	461
Modules III and IV—NEC Calculations Code and Section Index	465
 About the Author	469
About the Illustrator	470
About the Mike Holt Team	471



Mike Holt's 2023 Master Electrician Simulated Exams

TABLE OF CONTENTS

About This Book vii

CHAPTER 1—STUDY TIPS TO PASS YOUR EXAM 1

CHAPTER 2—HOW TO USE THE *NATIONAL ELECTRICAL CODE* 7

CHAPTER 3—MASTER SIMULATED EXAMS 17

 Master Simulated Exam A 19

 Master Simulated Exam B 39

CHAPTER 4—TEST-TAKING TIPS TO PASS YOUR EXAM 59

CHAPTER 5—STUDY OPTIONS 63

About Mike Holt 72