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First Year

Lesson 101 - Orientation and Basic Principles

- 101.1 **DESCRIBE** and **EXPLAIN** the apprenticeship policies and procedures of the IEC chapter sponsoring your training program.
- 101.2 **LIST** and **EXPLAIN** the advantages of being part of the IEC apprenticeship program.
- 101.3 **DESCRIBE** and **EXPLAIN** the IEC 4-year electrical apprenticeship program.
- 101.4 **RECOGNIZE** basic electrical terms.
- 101.5 **RECOGNIZE** basic NEC® definitions (Article 100).

Lesson 102 - Tools and Fasteners*

- 102.1 **RECOGNIZE** hand tools used in the trade by identifying the “do’s and don’ts” of their use and care.*
- 102.2 **RECOGNIZE** power tools used in the trade by identifying the “do’s and don’ts” of their use and care.
- 102.3 **DESCRIBE** torque wrenches and their use.
- 102.4 **RECALL** and **DEMONSTRATE** knowledge of electrical materials.
- 102.5 **IDENTIFY** hands-on tool activity.

Lesson 103 - Introduction to Safety, Navigating the NEC® and EWR Plans

- 103.1 **STATE** and **EXPLAIN** the GHS symbols and requirements.
- 103.2 **RECOGNIZE** requirements of NFPA 70E® on flexible cords and cables, highlighting GFCI protection and electrical hazards.
- 103.3 **STATE** general safety considerations in electrical installations.
- 103.4 **OUTLINE** a basic understanding of the creation and organization of the NEC®.
- 103.5 **DESCRIBE** the components of plans and specifications.

Lesson 104 - Introduction to Electric Charges and Basic Math

- 104.1 **RECOGNIZE** the law of electric charges and theories of current flow.
- 104.2 **ILLUSTRATE** knowledge of basic mathematics.

Lesson 105 - Applied Math, Circuit Theory, Plans & Specs

- 105.1 **MASTER** whole numbers, decimals, percentages, averages, fractions, and linear measures necessary in solving problems encountered by electricians.
- 105.2 **MASTER** conversions between English and metric units, Fahrenheit and Celsius temperatures; and conduct conversions among metric prefixes.
- 105.3 **POSSESS** a fundamental awareness of resistance, power, and electrical circuits.
- 105.4 **DESCRIBE** the basic information available on the EWR plans and specifications.

Lesson 106 - Applied Math, Ohm’s Law, Electrical Symbols, and Boxes

- 106.1 **MASTER** ratios, proportions, squared and square root numbers, area, and volume by applying their uses as a means of solving problems encountered by electricians.
- 106.2 **RECOGNIZE** the relationship between voltage, current, and resistance as demonstrated in Ohm’s Law.
- 106.3 **CONTRAST** results of using different applied voltages and resistances as demonstrated in Ohm’s Law.
- 106.4 **RECOGNIZE** various outlet boxes by identifying each outlet box’s characteristics.
- 106.5 **DESCRIBE** symbols presented within the text.

Lesson 107 - Conduit Bending*

- 107.1 **LABEL** the points on a hand bender and **LIST** terms used in conduit bending.*
- 107.2 **OUTLINE** mathematical calculations and apply them to bending conduit.
- 107.3 **DEMONSTRATE** conduit bending hands-on activity.

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Lesson 108 - Dwelling Circuit Requirements, Outlet Locations, and General Lighting Load*	
108.1	DEFINE circuit requirements in dwellings. RECOGNIZE the circuit requirement differences between a dwelling and a non-dwelling.
108.2	DEFINE outlet locations in dwellings. RECOGNIZE the outlet location differences between a dwelling and a non-dwelling.
108.3	OUTLINE NEC® calculation for the general lighting load.
Lesson 109 - Conductor Types, Ampacity, Overcurrent Protection, Type NM Cables, and Common Voltage Systems	
109.1	STATE appropriate insulation and material characteristics according to conductor types.
109.2	SELECT OCPD and conductor size for given loads.
109.3	LIST nonmetallic cable (NM-B and NM-B-PCS) installation requirements.
109.4	RECOGNIZE voltages from common voltage systems.
Lesson 110 - Voltage Drop, Cable, Conduit, and Tubing*	
110.1	RECOGNIZE and solve various single-phase voltage drop calculations using the K-method.
110.2	LIST cable installation requirements for Types AC and MC.
110.3	LIST conduit and tubing installation requirements.
Lesson 111 - Midterm Review and Exam	
111	This lesson will determine your proficiency in the subject matter from the previous lessons.
Lesson 112 - Conductor Terminology, Switches, and Receptacles*	
112.1	SELECT between grounding, grounded, and ungrounded conductors.
112.2	DESCRIBE the NEC® requirements for switches.
112.3	RECOGNIZE the construction, operation, and connection of switches.*
112.4	RECOGNIZE the construction and connection of receptacles by identifying each receptacle and its NEMA designation.
112.5	DESCRIBE the NEC® requirements for receptacles.
Lesson 113 - GFCI, AFCI, and Other Special-Purpose Receptacles*	
113.1	RECOGNIZE the purpose, operation, and installation of GFCI protective devices.*
113.2	RECOGNIZE the purpose, operation, and installation of AFCI protective devices.
113.3	RECOGNIZE the purpose, operation, and installation of IG, hospital grade, ALCI, and dual function protective devices.
113.4	DESCRIBE the NEC® requirements for IG, hospital grade, ALCI, and dual function protective devices.
113.5	DESCRIBE receptacle/GFCI/AFCI functions (referencing EWR plan).
Lesson 114 - Luminaires, Ballasts, and Lamps	
114.1	RECOGNIZE the purpose, operation, and installation of a luminaire. DESCRIBE thermal protection for luminaires.
114.2	SELECT ballast and lamp applications for luminaires.
114.3	LIST basic lighting terminology.
114.4	DESCRIBE the NEC® requirements for luminaires.
114.5	DESCRIBE the cost benefits of using energy efficient lighting.

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Lesson 115 - Box Fill and Introduction to Series Circuits (Front Bedroom)

- 115.1 **RECOGNIZE** lighting requirements in clothes closets and storage areas, per NEC®.
- 115.2 Using the EWR plans, **LOCATE** the circuits and outlets in the front bedroom, based on specifications.
- 115.3 **SELECT** Ohm's Law formulas for series circuits.
- 115.4 **OUTLINE** the minimum NEC® requirements for box fill.

Lesson 116 - Box Sizing and Series Circuits (Master Bedroom)*

- 116.1 Using the EWR plans, **LOCATE** the circuits and outlets in the Master Bedroom based on specifications and NEC® requirements.
- 116.2 **SELECT** proper box sizing for receptacle outlet, switch outlet, lighting outlet, and fan outlet. **RECALL** box fill calculations.
- 116.3 **RECOGNIZE** individual and series-connected DC power sources.*
- 116.4 **LABEL** "unknowns" for series circuits using Ohm's Law formulas.
- 116.5 **RECOGNIZE** and solve various single phase voltage drop calculations using the resistance method.

Lesson 117 - Lighting and Small Appliance Branch Circuits

- 117.1 Using the EWR plans, **LOCATE** the circuits and lighting in the bathrooms, hallways, foyer, and porch, based on specifications and NEC® requirements.
- 117.2 **DESCRIBE** installation for all indoor and outdoor lighting fixtures.
- 117.3 **RECOGNIZE** small-appliance branch circuit and receptacle outlet installation based on NEC® requirements.
- 117.4 **DRAW** a wiring diagram of cable layout and requirements for the kitchen small appliance circuits.

Lesson 118 - First Semester Final Exam

- 118 This lesson will determine your proficiency in the subject matter from the previous lessons.

Lesson 119 - Track Lighting, Dimmers, and Introduction to Parallel Circuits (Living Room)*

- 119.1 **DESCRIBE** the NEC® requirements for track lighting.
- 119.2 **RECOGNIZE** the operation and connection of dimmers.
- 119.3 **ILLUSTRATE** the layout of the living room and the bedroom/study circuits using specifications and the NEC®.
- 119.4 **RECOGNIZE** parallel-connected DC power sources.*
- 119.5 **SELECT** Ohm's Law formulas for parallel circuits.

Lesson 120 - Laundry and Bathroom Receptacles and Parallel Circuits

- 120.1 **DEFINE** the NEC® circuit and receptacle requirements for electrical clothes dryer outlets.
- 120.2 **DEFINE** the NEC® circuit and receptacle requirements for bathrooms, laundry room receptacles, and the installation requirements for exhaust and attic fans.
- 120.3 **FORMULATE** Ohm's Law while performing circuit calculations for parallel circuits.
- 120.4 **ILLUSTRATE** the layout of the laundry and attic and demonstrate an understanding of the layout using specifications and the NEC®.

Lesson 121 - Garage and Garage Door Circuits, Underground Installations, and Parallel Circuit Calculations

- 121.1 **DEFINE** NEC® requirements for branch circuit wiring protection for garages.
- 121.2 **DESCRIBE** underground requirements using conduit and nonmetallic cable.
- 121.3 **DESCRIBE** garage door opener circuitry including power and control wiring.
- 121.4 **SELECT** parallel circuit calculations for voltage, current, and power.

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Lesson 122 - Appliance and Special Purpose Outlets

- 122.1 **RECOGNIZE** branch circuit installation for special purpose outlets based on NEC® requirements.
- 122.2 **RECOGNIZE** the NEC® requirements for water heaters and their related disconnecting means, grounding, and overcurrent protection.
- 122.3 **RECOGNIZE** the expected voltmeter measurements across open and closed switches.
- 122.4 Using the EWR plans, **LOCATE** the circuits and information concerning the pump and water heater.

Lesson 123 - Ranges, Ovens, Counter-Mounted Cooking Units, and Other Kitchen Appliances

- 123.1 **MATCH** circuit and receptacle installation for kitchen ranges, ovens, and counter-mounted cooking equipment based on NEC® requirements.
- 123.2 **MATCH** the NEC® requirements for circuit and receptacle installation for kitchen appliances such as dishwashers and food waste disposals.
- 123.3 **SELECT** between direct (hard-wired/permanent) connections and cord-and-plug connections for kitchen equipment. **DESCRIBE** NEC® requirements for appliance disconnecting means.

Lesson 124 - Bathrooms, Exhaust Fans, and Hydromassage Tubs

- 124.1 **RECOGNIZE** the circuit installation for ceiling heat/vent/light units in bathrooms based on NEC® requirements.
- 124.2 **STATE** the control circuit wiring for exhaust fans and hydromassage tubs, and identify the required GFCI protection for each.
- 124.3 Using the EWR plans, **LOCATE** the circuit installation for bathrooms based on NEC® requirements.

Lesson 125 - Heating and Air Conditioning

- 125.1 **RECOGNIZE** circuit installation for heating cable, electric furnaces, electric baseboard heaters, heat pumps, and air conditioners based on NEC® requirements.
- 125.2 **STATE** the NEC® requirements for Class 2 control circuit wiring.
- 125.3 **RECOGNIZE** the data located on the nameplate of HVAC equipment.

Lesson 126 - Residential Limited Energy Systems*

- 126.1 **LIST** basic standard installation practices for limited energy residential systems based on NEC® requirements.*
- 126.2 Using the EWR plans, **LOCATE** the circuits and information concerning low-voltage and fire alarm.

Lesson 127 - Midterm Review and Exam

- 127 This lesson will determine your proficiency in the subject matter from the previous lessons.

Lesson 128 - Multiwire Branch Circuits and Introduction to Combination Circuits (Recreation Room)*

- 128.1 **RECOGNIZE** the method of installation of multiwire branch circuits according to NEC® standards.
- 128.2 **DEFINE** watt loss, voltage drop, and current flow in two-wire and three-wire circuits.
- 128.3 **SELECT** Ohm's Law formulas for combination circuits.
- 128.4 **DESCRIBE** the advantages of installing multiwire branch circuits and the effects on the connected loads when open neutrals occur.*
- 128.5 **RECOGNIZE** features and voltage of multiple battery connections.

Lesson 129 - Combination Circuits, Conductor Ampacity Correction, and Conduit Fill (Workshop)*

- 129.1 **FORMULATE** Ohm's Law while performing circuit calculations for combination circuits.
- 129.2 **SELECT** proper conduit size by utilizing tables 4 and 5 in the NEC®.*
- 129.3 **STATE** conductor ampacity using correction and adjustment factors. **SELECT** maximum ratings of overcurrent protection for conductors.
- 129.4 **RECOGNIZE** requirements for receptacles in a dwelling unit basement.

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Lesson 130 - Services and Service Equipment, and Cost of Electrical Power*	
130.1	RECOGNIZE the NEC® terminology and requirements for electrical service installations.
130.2	DESCRIBE the cost of using electricity through calculation.
Lesson 131 - Grounding and Bonding, Specialty Tools	
131.1	LIST components of grounding and bonding.
131.2	RECOGNIZE the installation requirements for grounding and bonding as per the NEC®.
131.3	RECOGNIZE and DEMONSTRATE use of specialty tools.
Lesson 132 - Overcurrent Protection and Circuit Conditions	
132.1	RECOGNIZE basic overcurrent device type, terminology, and operation.
132.2	RECOGNIZE the NEC® requirements for ratings, sizing, and installation requirements of various OCPDs.
132.3	RECOGNIZE possible circuit conditions (normal, short-circuit, overload, open, ground-fault).
132.4	Using the EWR drawing set, LOCATE information concerning overcurrent protection.
Lesson 133 - Service Entrance Calculations	
133.1	SELECT the size of the electrical service including conductors for a single-family dwelling.
133.2	Using the EWR drawing set, LOCATE information concerning the service calculation.
Lesson 134 - Swimming Pools, Spas, and Hot Tubs	
134.1	RECOGNIZE electrical hazards associated with pools, spas, and hot tubs.
134.2	DESCRIBE installation of electrical wiring for swimming pools, spas, and hot tubs based on NEC® requirements.
134.3	LIST bonding and grounding requirements for swimming pools, spas, and hot tubs based on information provided during class discussions and education materials.
134.4	Using the EWR drawing set, LOCATE information concerning the swimming pool.
Lesson 135 - Home Automation, Standby Power, and Photovoltaic Systems*	
135.1	RECOGNIZE structured wiring and wireless technology installations.
135.2	RECOGNIZE residential standby power systems, the NEC® requirements for installation, and the inherent safety issues.
135.3	RECOGNIZE solar photovoltaic system installation and NEC® requirements.
Lesson 136 - Second Semester Final Exam	
136	This lesson will determine your proficiency in the subject matter from the previous lessons.

* Additional resources may be found in the back of the book and/or CMS.

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comprehensive list of lesson objectives.

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Second Year	
Abbreviations and Special Notes and General Application Notes	
Lesson 201 - Construction Materials	
201.1	RECOGNIZE structural supports. DESCRIBE the uses of steel and metal in construction.
201.2	IDENTIFY wood construction materials. DESCRIBE wood framing types and methods.
201.3	DESCRIBE foundation types and foundation assembly methods.
201.4	DESCRIBE masonry types and masonry methods.
201.5	RECOGNIZE insulation, wall coverings, finishes, and firestopping methods.
Lesson 202 - Printreading: Project Design, Development, and Specifications*	
202.1	DESCRIBE project origins and construction professionals.
202.2	INTERPRET the purpose and format of specifications.*
202.3	INTERPRET specifications for the Wendy's restaurant project—Documentation.
202.4	INTERPRET specifications for the Wendy's restaurant project—Construction.
Lesson 203 - Printreading Basics	
203.1	RECOGNIZE and distinguish different prints: title page, civil, structural, architectural, electrical, mechanical, etc.
203.2	INTERPRET general notes, key notes, abbreviations, and symbols.
203.3	RECOGNIZE and IDENTIFY project plan lines, scales, and dimensions.
203.4	RECOGNIZE and distinguish different drawings: elevations, section drawings, detail drawings, and schedules.
Lesson 204 - Electrical Part I: Service, Distribution, and Panel Schedules	
204.1	INTERPRET and LIST electrical materials and methods.
204.2	RECOGNIZE electrical service and distribution components.
204.3	INTERPRET electrical panel schedules.
Lesson 205 - Electrical Part II: Lighting, Power, and Other Associated Drawings	
205.1	INTERPRET electrical lighting drawings.
205.2	INTERPRET electrical power drawings.
205.3	INTERPRET fire-alarm, communications, controls, and security systems.
205.4	INTERPRET electrical quantity take-off.
Lesson 206 - Site/Civil and Structural Drawings	
206.1	LOCATE and USE site, civil, and survey drawings.
206.2	INTERPRET foundation and structural floor plans.
206.3	INTERPRET photometric and site lighting plans.

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Lesson 207 - Mechanical and Plumbing Materials and Drawings

- 207.1 **INTERPRET** and **LIST** mechanical and plumbing materials and methods.
- 207.2 **INTERPRET** mechanical and plumbing equipment schedules.
- 207.3 **INTERPRET** mechanical drawings.
- 207.4 **INTERPRET** plumbing drawings.
- 207.5 **RECOGNIZE** how roofing types affect electrical installations.

Lesson 208 - Architectural Drawings

- 208.1 **RECOGNIZE** and **ANALYZE** architectural schedules.
- 208.2 **IDENTIFY** and **EXPLAIN** various wall types and their components.
- 208.3 **RECOGNIZE** and **ANALYZE** architectural details.
- 208.4 **DEMONSTRATE** coordination of drawings.

Lesson 209 - Midterm Review and Exam

- 209 This lesson will provide a review of the subject matter from previous lessons and determine your proficiency in the subject matter from previous lessons.

Lesson 210 - Code Study: NEC® Intro, Chapter 1, and Chapter 2, Articles 90, 100, 110, and 200

- 210.1 **IDENTIFY** key concepts and key words in NEC® Article 90.
- 210.2 **IDENTIFY** definitions in NEC® Article 100.
- 210.3 **IDENTIFY** key concepts and key words in NEC® Article 110.
- 210.4 **IDENTIFY** key concepts and key words in NEC® Article 200.

Lesson 211 - Code Study: NEC® Chapter 2, Article 210

- 211.1 **IDENTIFY** key concepts and key words in NEC® Article 210 Part I.
- 211.2 **IDENTIFY** key concepts and key words in NEC® Article 210 Part II.
- 211.3 **IDENTIFY** key concepts and key words in NEC® Article 210 Part III.

Lesson 212 - Code Study: NEC® Chapter 2, Articles 215, 220, 225, and 230

- 212.1 **IDENTIFY** key concepts and key words in NEC® Article 215.
- 212.2 **IDENTIFY** key concepts and key words in NEC® Article 220.
- 212.3 **IDENTIFY** examples in NEC® Informative Annex D and how they relate to Article 220.
- 212.4 **IDENTIFY** key concepts and key words in NEC® Article 225.
- 212.5 **IDENTIFY** key concepts and key words in NEC® Article 230.

Lesson 213 - Code Study: NEC® Chapter 2, Articles 240, 242, and 250

- 213.1 **IDENTIFY** key concepts and key words in NEC® Article 240.
- 213.2 **IDENTIFY** key concepts and key words in NEC® Article 242.
- 213.3 **IDENTIFY** key concepts and key words in NEC® Article 250, specifically equipment grounding conductors.
- 213.4 **IDENTIFY** key concepts and key words in NEC® Article 250, specifically main bonding jumper and grounding electrode system.

Lesson 214 - Code Study: NEC® Chapter 3, Articles 300 and 310

- 214.1 **IDENTIFY** key concepts and key words in NEC® Article 300.
- 214.2 **IDENTIFY** key concepts and key words in NEC® Article 310 Parts I and II.
- 214.3 **IDENTIFY** key concepts and key words in NEC® Article 310 Part III.
- 214.4 **IDENTIFY** Chapter 9 Table 8 and its relationship to conductors.

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Lesson 215 - Code Study: NEC® Chapter 3, Articles 312 and 314*

- 215.1 **IDENTIFY** key concepts and key words in NEC® Article 312.
- 215.2 **IDENTIFY** key concepts and key words in NEC® Article 314.
- 215.3 **FORMULATE** volume calculations for outlet, device, and junction boxes.*
- 215.4 **FORMULATE** calculations for pull box sizing.

Lesson 216 - Code Study: NEC® Chapter 3, Articles 320–393*

- 216.1 **IDENTIFY** code organization and structure standards as contained in NEC® Articles 320–393.
- 216.2 **IDENTIFY** key concepts and key words for cables as used in NEC® Articles 320–340.
- 216.3 **IDENTIFY** key concepts and key words for conduit and tubing as used in NEC® Articles 342–362.
- 216.4 **IDENTIFY** key concepts and key words for other raceway systems as used in NEC® Articles 366–393.
- 216.5 **IDENTIFY** Chapter 9 Tables 1, 4, and 5 and perform conduit fill calculations.*

Lesson 217 - First Semester Final Exam Review

- 217 This lesson will provide a review of the subject matter from previous lessons.

Lesson 218 - First Semester Final Exam

- 218 This lesson will determine your proficiency in the subject matter from the previous lessons.

Lesson 219 - Introduction to AC Theory

- 219.1 **DESCRIBE** and **CHOOSE** the terms used for electrical charges, magnetism, and electromagnetism.
- 219.2 **RECOGNIZE** basics of AC power, AC generation, frequency, voltage, and current.
- 219.3 **DEFINE** inductance and capacitance, and **CHOOSE** symbols and formulas for inductors and capacitors.

Lesson 220 - AC Theory: Inductive and Capacitive Reactance

- 220.1 **DEFINE** and compute inductive reactance and capacitive reactance in an AC circuit.
- 220.2 **DESCRIBE** and predict the leading and lagging effects on the voltage and current relationship when inductive reactance and capacitive reactance are present in an AC circuit.

Lesson 221 - AC Theory: Impedance and Power Factors*

- 221.1 **DEFINE** and **COMPUTE** impedance in series and parallel circuits.
- 221.2 **IDENTIFY** the relationship between true power, apparent power, and power factor.*

Lesson 222 - Single-Phase Transformers: Theory, Types, and Calculations*

- 222.1 **DESCRIBE** the basic transformer terms and theory.
- 222.2 **DESCRIBE** basic transformer types.
- 222.3 **MASTER** calculations and connections for single-phase, single-voltage transformers.*
- 222.4 **MASTER** calculations and connections for single-phase, dual-voltage transformers.*

Lesson 223 - Power Generation, Transmission, and Distribution; Introduction to Three-Phase Calculations

- 223.1 **RECOGNIZE** methods and components utilized in the generation, transmission, and distribution of power from various types of power plants.
- 223.2 **FORMULATE** power and current in three-phase systems.

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Lesson 224 - 3Ø Transformers*

- 224.1 **RECOGNIZE** and **EXPLAIN** three-phase transformers, three-wire, closed-delta secondary outputs, capacities, and connections. Identify proper primary tap connections and perform calculations.*
- 224.2 **RECOGNIZE** and **EXPLAIN** three-phase, four-wire, closed-delta secondary outputs, capacities, and connections. **PERFORM** current and power calculations.
- 224.3 **RECOGNIZE** and **EXPLAIN** three-phase, three-wire and four-wire, open-delta secondary outputs, capacities, and connections. **PERFORM** current and power calculations.
- 224.4 **RECOGNIZE** and explain three-phase, four-wire, wye secondary outputs, capacities, and connections for transformers and connected loads.*
- 224.5 **PERFORM** current, power, and tap calculations for transformers.

Lesson 225 - Buck-Boost Transformers: Single-Phase Connections and Applications*

- 225.1 **RECOGNIZE** and **EXPLAIN** additive and subtractive polarity and the output voltages of buck-boost transformers.
- 225.2 **RECOGNIZE** and **CHOOSE** applications involving buck-boost transformers. **PERFORM** the calculations for determining the output voltages and capacities of these transformers.
- 225.3 **COMPUTE** the output voltage when supply voltages are other than the table values.

Lesson 226 - Balancing Three-Phase Loads, Nonlinear Loads, Three-Phase Fault Currents, and Voltage Drop

- 226.1 **RECOGNIZE** and **EXPLAIN** the terms and solutions associated with balancing loads on wye-connected secondaries.
- 226.2 **RECOGNIZE** and **EXPLAIN** terms, symptoms, and solutions associated with nonlinear loads.
- 226.3 **FORMULATE** three-phase and single-phase bolted-fault currents.
- 226.4 **FORMULATE** three-phase and single-phase voltage drop.

Lesson 227 - Midterm Review and Exam

- 227 This lesson will provide a review of the subject matter from previous lessons and determine your proficiency in the subject matter from previous lessons.

Lesson 228 - Code Study: NEC® Chapter 4, Articles 400–408, 410, 422, and 424*

- 228.1 **IDENTIFY** key concepts and key words concerning flexible cords, cables, and fixture wires as used in NEC® 400 and 402.*
- 228.2 **IDENTIFY** key concepts and key words concerning switches, receptacles, switchboards, and panelboards as used in NEC® 404, 406, and 408.
- 228.3 **IDENTIFY** key concepts and key words concerning luminaires as used in NEC® 410.
- 228.4 **IDENTIFY** key concepts and key words as used in NEC® 422 and 424.

Lesson 229 - Code Study: NEC® Chapter 4, Articles 430, 440, 445, 450, and 480

- 229.1 **IDENTIFY** key concepts and key words as used in NEC® 430.
- 229.2 **IDENTIFY** key concepts and key words as used in NEC® 440.
- 229.3 **IDENTIFY** key concepts and key words as used in NEC® 445.
- 229.4 **IDENTIFY** key concepts and key words as used in NEC® 450.
- 229.5 **IDENTIFY** key concepts and key words as used in NEC® 480.

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Lesson 230 - Code Study: NEC® Chapter 5, Articles 500–506 and 511–516

- 230.1 **IDENTIFY** key concepts and key words as used in NEC® 500, 501, 502, and 503.
- 230.2 **IDENTIFY** key concepts and key words as used in NEC® 504, 505, and 506.
- 230.3 **IDENTIFY** key concepts and key words as used in NEC® 511, 513, 514, and 515.
- 230.4 **IDENTIFY** key concepts and key words as used in NEC® 516.

Lesson 231 - Code Study: NEC® Chapter 5, Articles 517–590

- 231.1 **IDENTIFY** key concepts and key words as used in NEC® 517.
- 231.2 **IDENTIFY** key concepts and key words as used in NEC® 518–540.
- 231.3 **IDENTIFY** key concepts and key words as used in NEC® 545–555.
- 231.4 **IDENTIFY** key concepts and key words as used in NEC® 590.

Lesson 232 - Code Study: NEC® Chapter 6, Articles 600–604, 620–645, and 680

- 232.1 **IDENTIFY** key concepts and key words as used in NEC® 600, 604, and 620.
- 232.2 **IDENTIFY** key concepts and key words as used in NEC® 625, 630, 640, and 645.
- 232.3 **IDENTIFY** key concepts and key words as used in NEC® 680.

Lesson 233 - Code Study: NEC® Chapter 6, Articles 690 and 695

- 233.1 **IDENTIFY** key concepts and key words as used in NEC® 690.
- 233.2 **IDENTIFY** key concepts and key words as used in NEC® 695.

Lesson 234 - Code Study: NEC® Chapter 7, Articles 700–705, 722, 724, 725, and 760

- 234.1 **IDENTIFY** key concepts and key words as used in NEC® 700, 701, and 702.
- 234.2 **IDENTIFY** key concepts and key words as used in NEC® 705.
- 234.3 **IDENTIFY** key concepts and key words as used in NEC® 722, 724, and 725.
- 234.4 **IDENTIFY** key concepts and key words as used in NEC® 760.

Lesson 235 - Final Exam Review

- 235 This lesson will provide a review of the subject matter from previous lessons.

Lesson 236 - Final Exam

- 236 This lesson will determine your proficiency in the subject matter from previous lessons.

* Additional resources may be found in the back of the book and/or CMS.

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Third Year	
Lesson 301 - Test Instruments, OSHA, NFPA 70E®, and Test Instrument Safety	
301.1	USE and correctly INTERPRET information on a digital meter display. List examples of electrical test instruments and demonstrate their uses.
301.2	RECALL the important key safety requirements relative to OSHA and NFPA 70E®.
301.3	DEMONSTRATE safe test instrument habits by using proper PPE and procedures.
Lesson 302 - Introduction to Grounding and Bonding; General Requirements	
302.1	REVIEW definitions for grounding and bonding.
302.2	IDENTIFY the components and explain the effective ground-fault path to facilitate the OCPD operation.
302.3	IDENTIFY objectionable currents and their effects.
Lesson 303 - System Grounding: Grounded Conductors, Systems Required to be Grounded, and Systems Not Permitted to be Grounded	
303.1	REVIEW the various common AC voltage systems. Determine which ARE REQUIRED to be grounded, which conductors are to be grounded, and which conductors are to be protected by overcurrent devices.
303.2	EXPLAIN a separately derived system.
303.3	REVIEW the various common AC voltage systems. Determine which systems and branch circuits are not required or are not permitted to be grounded.
303.4	DESCRIBE and EXPLAIN installation requirements and properly sized grounded conductors.
Lesson 304 - System Grounding: Separately Derived Systems, Main Bonding Jumpers, and System Bonding Jumpers*	
304.1	RECALL and EXPLAIN the function, installation requirements, and sizing of main and system bonding jumpers.*
304.2	ASSESS grounding and installation requirements for separately derived systems.
304.3	ASSESS the grounding requirements for two or more buildings or structures supplied by feeders or branch circuits.
304.4	ASSESS the grounding requirements for portable and vehicle-mounted generators and impedance grounded systems.
Lesson 305 - Grounding Electrode Systems and Grounding Electrode Conductors*	
305.1	EXPLAIN general requirements for the grounding electrode system. CHOOSE which types of electrodes are permitted and the correct installation of the electrodes.
305.2	REVIEW requirements for grounding electrode conductors.*
305.3	REVIEW sizing for grounding electrode conductors.
Lesson 306 - Supply-Side and Load-Side Bonding Jumpers	
306.1	DEMONSTRATE the requirements for supply-side bonding jumpers including materials used, installation, and sizing.
306.2	DEMONSTRATE the requirements for load-side bonding jumpers including materials used, installation, and sizing.
Lesson 307 - Equipment Grounding and Equipment Grounding Conductors	
307.1	IDENTIFY effective equipment grounding and recognize the difference between short circuit and ground fault.
307.2	REVIEW grounding requirements for fastened-in-place equipment.
307.3	REVIEW sizing for equipment grounding conductors.

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Lesson 308 - Grounding of Specific Equipment and Conditions

- 308.1 **RECOGNIZE** and **LIST** the methods of equipment grounding conductor connections.
- 308.2 **SHOW** the normally non-current-carrying metal parts of equipment and identify the supports that are required to be connected to the equipment grounding conductor of a circuit. Explain why this connection is necessary.
- 308.3 **LOCATE** and **APPLY** the provisions for grounding in Chapter 5 and 6 of the NEC®.

Lesson 309 - Midterm Review and Exam

- 309 This lesson will determine your proficiency in the subject matter of previous lessons.

Lesson 310 - DC Motors, AC Single-Phase and Polyphase Motors

- 310.1 **DESCRIBE** and **EXPLAIN** the operation, construction, and required connections for DC motors.
- 310.2 **DESCRIBE** and **EXPLAIN** the operation, construction, and required connections for single-phase AC motors.
- 310.3 **DESCRIBE** and **EXPLAIN** three-phase operation of wound-rotor, synchronous, and squirrel-cage induction motors.
- 310.4 **RECOGNIZE** and **DEMONSTRATE** proper connections of wye- and delta-wound squirrel-cage induction motors.
- 310.5 **RECOGNIZE** enclosure types and nameplate information for three-phase motors.

Lesson 311 - Motors: General Knowledge and Sizing Branch Circuit Conductors

- 311.1 **SELECT** proper size branch circuit conductors for single-phase motors.
- 311.2 **SELECT** proper size branch circuit conductors for three-phase motors.
- 311.3 **SELECT** proper size flexible cord conductors for motors.
- 311.4 **MASTER** adjustment factors for motor branch circuits due to voltage drop, ambient temperature, and/or multiple conductors in a raceway.

Lesson 312 - Sizing Motor Short-Circuit and Ground-Fault Protection; Locked Rotor Current

- 312.1 **SELECT** proper size short-circuit and ground-fault protection for single-phase motor branch circuits.
- 312.2 **SELECT** proper size short-circuit and ground-fault protection for polyphase motor branch circuits.
- 312.3 **DESCRIBE** the fundamentals of motor locked rotor current. **COMPUTE** approximate locked rotor current when a motor starts or stalls.
- 312.4 **CONTRAST** the minimum equipment grounding conductor size for motor branch circuit installations and branch circuit installations.

Lesson 313 - Sizing Motor Overloads and Disconnects

- 313.1 **DESCRIBE** the purpose and function of motor overloads.
- 313.2 **SELECT** overload protection for installation in a motor starter.
- 313.3 **RECOGNIZE** the devices that can be used as a disconnecting means for a motor.

Lesson 314 - Motor Feeder Conductors, OCPDs, and Tap Conductors

- 314.1 **FORMULATE** proper size motor feeder conductors.
- 314.2 **FORMULATE** proper size motor feeder short-circuit and ground-fault protection.
- 314.3 **FORMULATE** proper size motor feeder tap conductors.

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Lesson 315 - Adjustable-Speed Drive Systems, Code, and Introduction to Motor Speed Control Methods	
315.1	DESCRIBE adjustable-speed drive system technology and CONTRAST it to traditional motor circuitry.
315.2	DESCRIBE and APPLY speed control methods for various classifications of motor loads.
Lesson 316 - AC Equipment, Fire Pumps	
316.1	FORMULATE the minimum size for conductors, safety switches, and OCPDs used for air conditioning and refrigeration equipment branch circuits.
316.2	RECOGNIZE the NEC [®] requirements for fire pumps.
Lesson 317 - First Semester Final Exam Review	
317	This lesson will provide a review of the subject matter from previous lessons.
Lesson 318 - First Semester Final Exam	
318	This lesson will determine your proficiency in the subject matter from previous lessons.
Lesson 319 - Introduction to Ladder Logic, Pushbuttons	
319.1	RECOGNIZE inputs and outputs. LABEL various switches and loads as input or output.
319.2	RECOGNIZE correct symbology and operation for toggle switches, pushbuttons, and basic loads.
319.3	WRITE simple ladder diagrams. LABEL ladder diagrams.
Lesson 320 - Manual Control Devices, Hands-On Activity*	
320.1	RECOGNIZE correct symbology and operation for manual control devices (pushbuttons, selector switches, joysticks, and foot switches).
320.2	From the work description, ILLUSTRATE ladder diagrams and CONNECT manual control devices in the hands-on activity.*
Lesson 321 - Automatic Control Devices, Hands-On Activity*	
321.1	RECOGNIZE correct symbology and operation for automatic control devices (limit, pressure, temperature, float, flow, photocell, and time switches).
321.2	From the work description, ILLUSTRATE ladder diagrams and CONNECT automatic control devices in the hands-on activity.*
Lesson 322 - Relays, Solid-State Relays, Contactors, Hands-On Activities*	
322.1	RECOGNIZE and EXPLAIN the magnetic solenoid action required to operate magnetic control devices. USE correct solenoid symbology in ladder logic diagrams.
322.2	RECOGNIZE the purpose and function of contactors and relays. SHOW what happens to contacts when the coils are energized.
322.3	IDENTIFY the basic types of solid-state relays and indicate their characteristics in comparison to electromechanical relays.
322.4	From the work description, ILLUSTRATE ladder diagrams and CONNECT various contactors and relays in the hands-on activity.*
Lesson 323 - Holding Circuits, Hands-On Activities*	
323.1	MASTER the connection of holding circuits for relays and contactors.
323.2	From the work description, ILLUSTRATE ladder diagrams and CONNECT various scenarios with holding contacts in the hands-on activity.*

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Lesson 324 - Timing Relays: On-Delay, Interval, and Recycle*

- 324.1 **CONTRAST** timing relays with non-timing relays. **LIST** the types of timers available, identify timing modes, and recognize the symbols used for timing relay contacts in ladder diagrams.
- 324.2 **SELECT** and **ILLUSTRATE** the operation of on-delay timing relays.
- 324.3 **SELECT** and **ILLUSTRATE** the operation of interval and recycle (repeat) timing relays.
- 324.4 From the work description, **ILLUSTRATE** ladder diagrams and **CONNECT** various scenarios with 8-pin relays in the hands-on activity.*

Lesson 325 - Timing Relays: Off-Delay, One-Shot, and Multifunction; Hands-On Activities*

- 325.1 **SELECT** and **ILLUSTRATE** the operation of off-delay timing relays.
- 325.2 **SELECT** and **ILLUSTRATE** the operation of one-shot timing relays.
- 325.3 **SELECT** and **ILLUSTRATE** the operation of multifunction timing relays.
- 325.4 From the work description, **ILLUSTRATE** ladder diagrams and **CONNECT** various scenarios with 11-pin relays in the hands-on activity.*

Lesson 326 - Ladder Logic Line Diagram: Critical Thinking Activity

- 326.1 **DEMONSTRATE** an understanding of control concepts and ladder logic line diagrams by creating and explaining a control circuit scenario.

Lesson 327 - Midterm Review and Exam

- 327 This lesson will determine your proficiency in the subject matter of previous lessons.

Lesson 328 - Magnetic Motor Starters, Control Circuit Overview, Hands-On Activity*

- 328.1 **RECOGNIZE** the purpose and function of motor starters.
- 328.2 **LABEL** connection terminals on motor starters. **MASTER** connection of motor starters to electrical circuitry. **SHOW** what happens to contacts (holding, auxiliary) when the coils are energized.
- 328.3 **RECALL** the purpose and function of motor overloads.
- 328.4 **IDENTIFY** motor starter components (hands-on activity).*

Lesson 329 - Motor Power Connections, NEMA Enclosures, Hands-On Activity*

- 329.1 **DEMONSTRATE** motor power connections as required for the available circuit voltage.
- 329.2 **REVIEW** NEMA enclosure classifications as they apply to environmental conditions.
- 329.3 From the work description, **ILLUSTRATE** ladder diagrams and **CONNECT** magnetic motor starters in the hands-on activity.*

Lesson 330 - Motor Reversing: Controllers and Connections, Hands-On Activity*

- 330.1 **DESCRIBE** and **USE** manual methods to reverse the rotation of a three-phase motor.
- 330.2 **DESCRIBE** and **USE** magnetic motor starters to reverse the rotation of a three-phase motor.
- 330.3 From the work description, **ILLUSTRATE** ladder diagrams and **CONNECT** a reversing magnetic motor in the hands-on activity.*

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Lesson 331 - Jogging Circuits, Latching Relays, Alternating Relays, Phase-Loss Relays; Hands-On Activity*

- 331.1 **DESCRIBE** the operation and function of jogging circuits.
- 331.2 **DESCRIBE** the operation and function of latching relays.
- 331.3 **DESCRIBE** the operation and function of alternating relays.
- 331.4 **INDICATE** the effects of phase loss on a motor. **DESCRIBE** the operation and function of a phase-loss relay.
- 331.5 From the work description, **ILLUSTRATE** ladder diagrams and **CONNECT** jogging circuits, latching relays, alternating relays, or phase-loss relays in the hands-on activity.*

Lesson 332 - Introduction to Limited Energy/Low-Voltage Systems

- 332.1 **RECOGNIZE** and **EXPLAIN** the basic functions of a structured cabling system as it relates to limited energy / low-voltage systems.
- 332.2 **RECOGNIZE** and **EXPLAIN** types of twisted pair structured cable (UTP), connectors, terminal blocks, terminations, and applications such as PoE.
- 332.3 **RECOGNIZE** and **EXPLAIN** types of coaxial cable, connectors, and terminations.
- 332.4 **RECOGNIZE** and **EXPLAIN** types of fiber, fiber connectors, and terminations.

Lesson 333 - Building the Foundation of the Productive Worker

- 333.1 **RECOGNIZE** types of motivation.
- 333.2 **LIST** elements of planning skills.
- 333.3 **DESCRIBE** key elements of organization.
- 333.4 **IDENTIFY** ways to increase personal productivity.

Lesson 334 - Transition to Supervisor

- 334.1 **IDENTIFY** motivation types as they apply to supervision.
- 334.2 **OUTLINE** steps in task planning.
- 334.3 **LIST** key elements of organization.
- 334.4 **IDENTIFY** key concepts of productivity.

Lesson 335 - Final Exam Review

- 335 This lesson will provide a review of the subject matter from the previous lessons.

Lesson 336 - Final Exam

- 336 This lesson will determine your proficiency in the subject matter from the previous lessons.

* Additional resources may be found in the back of the book and/or CMS.

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comprehensive list of lesson objectives.

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Lesson 401 - Energized Electrical Work Relative to NFPA 70E®	
401.1	DEMONSTRATE a broad understanding on working on or near energized electrical equipment as explained by OSHA and NFPA 70E®.
Lesson 402 - Introduction to Programmable Logic Controllers and Relays*	
402.1	DEFINE different types of programmable controllers.
402.2	CONTRAST programmable logic relays (PLRs) to traditional mechanical controls.
402.3	DEMONSTRATE a hands-on activity related to programmable logic relays (PLRs).
Lesson 403 - Introduction to Programming PLRs*	
403.1	DESCRIBE programming symbols, language, and force and disable commands. USE basic programming symbols and logic functions.
403.2	DEMONSTRATE a hands-on activity related to programmable logic relays (PLRs).
Lesson 404 - Variable Frequency Drives (VFDs): Motor Starting Methods, Accelerate/Decelerate*	
404.1	UNDERSTAND industry abbreviations and definitions related to variable frequency drives (VFDs). DEFINE the basic anatomy of a VFD.
404.2	REVIEW VFD motor starting concepts for acceleration and deceleration. COMPARE advantages and disadvantages of using VFDs over other motor control methods.
404.3	LIST and EXPLAIN the next career moves for someone interested in specializing in variable frequency drives (VFDs).
404.4	DEMONSTRATE a hands-on activity related to variable frequency drives (VFDs).
Lesson 405 - Power Quality	
405.1	UNDERSTAND industry abbreviations and definitions related to power quality.
405.2	REVIEW power quality and power distribution concepts.
405.3	DESCRIBE various standards and career paths.
Lesson 406 - Introduction to Solar Photovoltaics*	
406.1	UNDERSTAND industry abbreviations and definitions related to photovoltaic systems.
406.2	DESCRIBE and apply the basic functions of a photovoltaic system.
406.3	LIST and EXPLAIN the next career moves for someone interested in specializing in photovoltaic systems.
406.4	DEMONSTRATE a hands-on activity related to photovoltaic systems.
Lesson 407 - Introduction to Electric Vehicles, Electric Vehicle Chargers, and Energy Storage	
407.1	COMPARE electric vehicle (EV) types and UNDERSTAND the differences between them.
407.2	COMPARE EV charger types and UNDERSTAND the differences between them.
407.3	COMPARE energy storage systems and UNDERSTAND the differences between them.
407.4	REVIEW NEC® requirements for EV charging systems.
Lesson 408 - Introduction to Supervision	
408.1	DEFINE a supervisor and RECOGNIZE characteristics that will help a production worker transition to a supervisor.
408.2	LIST skills of a supervisor and DESCRIBE how to cultivate and improve these skills.
408.3	RECOGNIZE the value of good supervision and why it is important for your company and to your career.
408.4	LIST job titles that require supervision skills and where to find additional training.
Lesson 409 - Midterm Review and Exam	
409	This lesson will determine your proficiency in the subject matter from the previous lessons.

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Lesson 410 - Introduction to Limited Energy Systems, Structured Cabling*	
410.1	INTERPRET industry abbreviations and definitions related to Limited Energy/Low Voltage Systems. RECOGNIZE tools used for low voltage installations.
410.2	DESCRIBE and APPLY the basic functions of a structured cabling system.
410.3	LIST and EXPLAIN the next career moves for someone interested in specializing in structured cabling.
410.4	DEMONSTRATE a hands-on activity related to structured cabling.
Lesson 411 - Home Automation	
411.1	DEFINE industry abbreviations and definitions related to home automation.
411.2	DESCRIBE and APPLY the basic functions of a home automation system.
411.3	LIST and EXPLAIN the next career moves for someone interested in specializing in home automation.
Lesson 412 - Audio/Sounds Systems and Video Surveillance Systems	
412.1	DEFINE industry abbreviations and definitions related to audio/sound systems and video surveillance systems.
412.2	DESCRIBE and APPLY the basic functions of audio/sound systems and video surveillance systems.
412.3	LIST and EXPLAIN the next career moves for someone interested in audio/sound systems and video surveillance systems.
Lesson 413 - Introduction to Building Automation Systems (BAS)	
413.1	DEFINE industry abbreviations and definitions related to building automation systems.
413.2	DESCRIBE and APPLY the basic functions of a building automation system.
413.3	LIST and EXPLAIN the next career moves for someone interested in building automation systems.
Lesson 414 - Fire Alarm Systems*	
414.1	DEFINE industry abbreviations and definitions related to fire alarm systems.
414.2	DESCRIBE and APPLY the basic functions of a fire alarm system.
414.3	LIST and EXPLAIN the next career moves for someone interested in specializing in fire alarm systems.
414.4	DEMONSTRATE a hands-on activity related to fire alarm systems.
Lesson 415 - Predictive and Preventive Maintenance	
415.1	DEFINE industry abbreviations and definitions related to predictive and preventive maintenance.
415.2	DESCRIBE the differences between predictive and preventive maintenance. IDENTIFY the methods used to conduct predictive and preventive maintenance.
415.3	LIST and EXPLAIN the next career moves for someone interested in predictive and preventive maintenance.
Lesson 416 - Troubleshooting*	
416.1	DEFINE the troubleshooting process.
416.2	PERFORM the process of troubleshooting.
Lesson 417 - First Semester Final Exam Review	
417	This lesson will provide a review of the subject matter from previous lessons.
Lesson 418 - First Semester Final Exam	
418	This lesson will determine your proficiency in the subject matter from previous lessons.

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Lesson 419 - Using and Applying NEC® 90, 100, and 110	
419.1	POSSESS an understanding of the creation, format, structure, and practical application of the <i>National Electrical Code</i> ® (NEC®). IDENTIFY the scope, purpose, arrangement, and enforcement of the NEC® as contained in NEC 90®.
419.2	RECALL definitions of electrical terms and equipment in order to adequately prepare for the study, interpretation, and application of NEC® Article 100.
419.3	RECALL the requirements for electrical installations of equipment and conductors according to Article 110 of the NEC®.
419.4	RECOGNIZE voltages and properties of various electrical systems.
Lesson 420 - Branch Circuits and Feeders, NEC® 210 and 215	
420.1	RECALL branch circuit requirements as contained in NEC® Article 210 regarding GFCI and AFCI protection and branch circuit ratings.
420.2	RECALL required branch circuits and required outlets found in NEC® Article 210.
420.3	RECALL feeder requirements as contained in NEC® Article 215.
Lesson 421 - Load Calculations, NEC® 220—Part 1	
421.1	REVIEW NEC® requirements for branch circuit calculations.
421.2	REVIEW NEC® requirements for electric cooking appliance calculations.
421.3	REVIEW NEC® requirements for standard feeder and service load calculations for a dwelling.
Lesson 422 - Load Calculations, NEC® 220—Part 2	
422.1	REVIEW NEC® requirements for standard feeder and service load calculations for a multifamily dwelling.
422.2	REVIEW NEC® requirements for optional feeder and service load calculations.
422.3	REVIEW NEC® requirements for commercial feeder and service load calculations.
Lesson 423 - Services, NEC® 230	
423.1	IDENTIFY the key components for electrical services.
423.2	POSSESS a fundamental understanding of the clearances and other requirements for overhead services.
423.3	POSSESS a fundamental understanding of the clearances and other requirements for underground services.
423.4	IDENTIFY the requirements for service equipment.
Lesson 424 - Conductors and Overcurrent, NEC® 100, 110, 240, 310	
424.1	POSSESS a fundamental understanding of ampacity, termination, insulation ratings, ambient temperature, and other adjustment factors of circuit conductors.
424.2	MASTER the purpose and the selection of fuses and circuit breakers for the protection of conductors and equipment.
424.3	IDENTIFY the characteristics of branch circuits, feeders, and taps.
424.4	INDICATE practical application of OCPDs.
Lesson 425 - Grounding, NEC® 250	
425.1	IDENTIFY grounding terminology and functionality.
425.2	MASTER the installation and sizing of the main bonding or system bonding jumper.
425.3	MASTER the installation of grounding electrodes and the sizing of grounding electrode conductors.
425.4	MASTER the purpose, installation, and sizing of equipment grounding conductors.

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Lesson 426 - Wiring Methods, NEC® Chapter 3	
426.1	REVIEW the general requirements and installation practices for all wiring methods as described in NEC® Article 300.
426.2	RECALL properties and NEC® requirements for various cables, raceways, and other wiring methods.
426.3	REVIEW calculations for sizing raceways and wireways.
426.4	REVIEW calculations for sizing outlet device and junction boxes.
426.5	REVIEW calculations for sizing pull boxes containing 4 AWG or larger.
Lesson 427 - Midterm Review and Exam	
427	This lesson will determine your proficiency in the subject matter from the previous lessons.
Lesson 428 - Switches, Switchgear, Panelboard, NEC® 404 and 408	
428.1	MASTER general requirements for switches as per NEC® 404.
428.2	RECOGNIZE characteristics of switchboards and panelboard as per NEC® 408.
Lesson 429 - Equipment for General Use, NEC® 400, 406, 410, and 422	
429.1	REVIEW the rating, installation, and overcurrent protection requirements for flexible cords.
429.2	REVIEW the type, grounding, and installation requirements for receptacles, cord connectors, and attachment plugs.
429.3	REVIEW the location, support, grounding, and installation requirements for luminaires.
429.4	REVIEW the branch circuit ratings, overcurrent protection, disconnecting means, markings, and installation requirements for appliances.
Lesson 430 - Equipment for General Use, NEC® 430, 440, 445, and 695	
430.1	REVIEW motors, motor circuits, and motor controllers.
430.2	REVIEW air conditioning and refrigeration equipment.
430.3	REVIEW generators.
430.4	REVIEW fire pump requirements.
Lesson 431 - Transformers: NEC® 450	
431.1	RECALL various types of transformers and their construction.
431.2	IDENTIFY NEC® and manufacturer's transformer installation requirements.
431.3	IDENTIFY NEC® requirements for transformer vaults.
431.4	MASTER the NEC® requirements for the protection of transformers and primary conductors against overcurrent.
431.5	MASTER the NEC® requirements for the protection of transformer secondary conductors (taps) against overcurrent.
Lesson 432 - Special Locations: NEC® 500-504, 511, 514, 517, and 590	
432.1	IDENTIFY NEC® requirements for hazardous locations and their classifications.
432.2	IDENTIFY NEC® requirements for commercial garages and motor fuel dispensing facilities.
432.3	IDENTIFY NEC® requirements for health care facilities.
432.4	IDENTIFY NEC® requirements for temporary installations.

Lesson 433 - Renewable Energy: NEC® 625, 690, 691, 694, 705, and 706

- 433.1 **REVIEW** NEC® requirements for electric vehicle power transfer systems.
- 433.2 **REVIEW** NEC® requirements for solar photovoltaic systems.
- 433.3 **REVIEW** NEC® requirements for wind electric systems.
- 433.4 **REVIEW** NEC® requirements for interconnected electric power production sources.
- 433.5 **REVIEW** NEC® requirements for energy storage systems.

Lesson 434 - Electrical License Exam Preparation

- 434.1 **UNDERSTAND** how to prepare to take an electrical licensing exam.
- 434.2 **DEMONSTRATE** trade knowledge and use of the NEC® in a practice licensing exam.

Lesson 435 - Second Semester Final Exam Review

- 435 This lesson will provide a review of the subject matter from previous lessons.

Lesson 436 - Second Semester Final Exam

- 436 This lesson will determine your proficiency in the subject matter from previous lessons.

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