

# ELECTRICITY (413)

## 413-301. Beginning Electrical Concepts. (2 Credits)

Gain an overview of the electrical industry and fundamental electrical theory. Explore basic electricity through concepts of DC electricity. Focus on the electron theory, voltage, amperage, resistance, Ohm's law and series/parallel circuits.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=301>)

## 413-302. Reading Construction Drawings. (2 Credits)

Develop skills in interpreting construction blueprints by categorizing elements of plans by view, size, shape and symbol. Focus on the essential elements of residential and commercial plans. Integrate basic blueprint reading skills with the construction process.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=302>)

## 413-305. Electrical Basic Theory. (2 Credits)

Students will learn fundamentals of electrical systems. After learning theories of electricity in the classroom, students will learn installation procedures in electrical lab using hand and power tools. Students will learn safe operation of hand and power tools.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=305>)

## 413-306. Residential Wiring Concepts. (2 Credits)

## 413-307. Res & Comm Wiring Concepts. (3 Credits)

Learn the skills and concepts needed to plan and install electrical equipment in residential and commercial occupancies. Explore the uses of raceways, conductors, boxes and power distribution equipment in residential and commercial work.

Prerequisites: 413-308 (may be taken concurrently) with a minimum grade of C and (801-311 (may be taken concurrently) with a minimum grade of C- or 801-136 (may be taken concurrently) with a minimum grade of C- or 801-195 (may be taken concurrently) with a minimum grade of C- or 801-223 (may be taken concurrently) with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=307>)

## 413-308. Construction Trades Safety. (1 Credit)

Explore OSHA policies, lockout/tagout procedures and standards, construction safety issues and Heartsaver First Aid CPR AED. Use OSHA regulations as a guide to working safely on various construction sites and recognizing potential hazards. Upon successful completion, receive an OSHA Construction Safety and Health 10-hour Course Card and a Heartsaver First Aid CPR AED Course Completion Card.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=308>)

## 413-309. Introduction to NEC. (2 Credits)

Gain an introduction to the uses and applications of the state and national electrical codes. Explore standard definitions, enforcement issues and the code-making cycle. Focus on electrical installations to determine compliance with the state and national electrical codes.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=309>)

## 413-310. Electricity for HVAC/Basic. (1 Credit)

Develop a basic understanding of electricity as applied to HVAC/ refrigeration. Learn basic electrical theory along with application and use of measuring devices.

Prerequisites: 401-309 (may be taken concurrently) with a minimum grade of C-

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=310>)

## 413-311. Intermediate NEC. (2 Credits)

Explore standards and procedures used by electricians in determining requirements for electrical installations. Focus on the process of using the code to make decisions and how different occupancies, such as residential, commercial or industrial, affect the electrical installation process.

Prerequisites: 413-309 with a minimum grade of C

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=311>)

## 413-313. Industrial Wiring Concepts. (3 Credits)

Learn the features and functions of electrical equipment in an industrial setting. Build skills to interpret line diagrams and use them to wire control circuits. Explore control circuits most commonly found in a manufacturing setting.

Prerequisites: 413-308 with a minimum grade of C and 413-307 with a minimum grade of C or (413-317 with a minimum grade of C and 413-319 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=313>)

## 413-316. Advanced Electrical Concepts. (2 Credits)

Building on Beginning Electrical Concepts, explore AC theory, inductance, capacitance and series-parallel circuits, single- and three-phase motors, transformers and circuits.

Prerequisites: 413-301 with a minimum grade of C and 413-308 with a minimum grade of C

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=316>)

## 413-317. Intro to Resid & Comm Wiring. (2 Credits)

Gain an introduction to the skills and concepts necessary for planning and installing electrical equipment in residential and commercial occupancies. Explore the uses of raceways, conductors, boxes and power distribution equipment in residential and commercial work.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=317>)

## 413-318. Trends in Electricity. (1 Credit)

Explore current trends and recent developments in residential and commercial electricity. Trends change based on current events within the industry. Focus on code, enforcement issues, new materials, equipment and techniques surrounding the new developments. Apply what you learn through hands-on activities.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=318>)

## 413-319. Adv Residential & Comm Wiring. (2 Credits)

Explore advanced skills and concepts necessary for planning and installing electrical equipment in residential and commercial occupancies. Learn to design, install and troubleshoot raceways, conductors, boxes and power distribution equipment in residential and commercial work.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=319>)

**413-320. Elect Pwr Ctrl & Motors. (3 Credits)**

Study power distribution circuits including transmission substation (high voltage), distribution substation (medium voltage) and in-plant distribution. Explore the construction and operation of DC motors and single-phase and three-phase AC motors. Become familiar with elementary industrial control circuits. Construct, wire, test and operate a typical industrial control panel.

Prerequisites: 413-308 with a minimum grade of C- and 413-313 (may be taken concurrently) with a minimum grade of C-

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=320>)

**413-321. Res & Comm Wiring Concepts. (2 Credits)**

Learn the skills and concepts needed to plan and install electrical equipment in residential and commercial occupancies. Explore the uses of raceways, conductors, boxes and power distribution equipment in residential and commercial work.

Prerequisites: 413-308 (may be taken concurrently) with a minimum grade of C

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=321>)

**413-322. Trends in Electricity. (2 Credits)**

Explore current trends and recent developments in residential and commercial electricity. Trends change based on current events within the industry. Focus on code, enforcement issues, new materials, equipment and techniques surrounding the new developments. Apply what you learn through hands-on activities.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=322>)

**413-333. Industrial Wiring Concepts. (2 Credits)**

Learn the features and functions of electrical equipment in an industrial setting. Build skills to interpret line diagrams and use them to wire control circuits. Explore control circuits most commonly found in a manufacturing setting.

Prerequisites: 413-308 with a minimum grade of C and (413-321 with a minimum grade of C or 413-317 with a minimum grade of C and 413-319 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=333>)

**413-409. Arc Flash Safety. (0.4 Credits)**

This course will provide instruction enabling students to improve electrical safety on the job.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=409>)

**413-418. Electrical NEC Code. (2.4 Credits)**

In this course the student will study the Wisconsin Electrical Code and the National Electrical Code (NEC) as they are applied to residential and commercial installations, and minimum code requirements as they regulate wiring methods, equipment, occupancies, and special conditions.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=418>)

**413-419. Electrical NEC Exam Prep. (2.4 Credits)**

In this course the student will study the residential and commercial (NEC) electrical codes and systems. This course will prepare the learner to write the state master/journeyman exam.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=419>)

**413-421. Arc Flash Safety 5 hrs. (0.5 Credits)**

This course will provide participants with an understanding of how to improve electrical safety on the job.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=421>)

**413-478. Electrical Code/Electricians. (4 Credits)**

The first course, of a two-course progression, which gives the student the opportunity to study the Wisconsin Electrical Code and the National Electrical Code (NEC) as they are applied to residential and commercial installations, minimum code requirements as they regulate wiring methods, equipment, occupancies, and special conditions.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=478>)

**413-486. Electrical Code Exam Prep. (4 Credits)**

The second course, of a two-course progression, which gives the student the opportunity to study the residential and commercial electrical codes and systems. This course will prepare the learner to write the state master/journeyman exam.

Prerequisites: (413-478 (may be taken concurrently) with a minimum grade of S)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=486>)

**413-501. Industrial Electrician Rel I. (4 Credits)**

Apprentices are introduced to electrical code as well as magnetic and AC/DC fundamentals. This is the first of a seven-semester sequence for Industrial Electrician apprentices. On-the-job safety is stressed at every opportunity in the classroom, lab, and worksite.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=501>)

**413-502. Industrial Electrician Rel II. (4 Credits)**

Examine topics including electrical code, A/C fundamentals, schematics, print reading, A/C and D/C motors. Safety is stressed in the classroom, lab, and worksite.

Prerequisites: (413-501 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=502>)

**413-503. Industrial Electrician Rel III. (4 Credits)**

Explore electrical code, transformers, motor controls and solid-state devices. Expand schematic print ready ability. Safety is stressed in the classroom, lab, and worksite.

Prerequisites: (413-502 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=503>)

**413-504. Industrial Electrician Rel IV. (4 Credits)**

Expand knowledge of electrical code, motor controls and solid state electronics. Become familiar with variable speed drives. Safety is stressed in the classroom, lab, and worksite.

Prerequisites: (413-503 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=504>)

**413-505. Industrial Electrician Rel V. (4 Credits)**

Further expand upon schematic print reading ability. Learn how programmable logic controllers (PLC) are used in industrial applications. Safety is stressed in the classroom, lab, and worksite.

Prerequisites: (413-504 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=505>)

**413-508. Industrial Electrician Rel VI. (3 Credits)**

Learn the safe and appropriate methods to program and maintain programmable logic controllers (PLC's).

Prerequisites: (413-505 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=508>)

**413-510. IE Apprentice Code Review. (1 Credit)**

Industrial Electrician Apprentices will review and apply current National Electrical Code (NEC).

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=510>)

**413-518. ABC Construction Elec Appr IVB. (2 Credits)**

Explore topics such as advanced controls, signaling systems, specialty transformers, standby and emergency systems, welding machines, HVAC controls, heat tracing, and freeze protection.

Prerequisites: (413-517 with a minimum grade of D-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=518>)

**413-519. ABC Construction Elect Appr VA. (2 Credits)**

Study the principles and applications of advanced electronic theory, voice and data systems, busses and networks, and fiber optics.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=519>)

**413-520. ABC Construction Electappr VB. (2 Credits)**

Broaden knowledge of programmable logic controllers, medical systems, and TV and antenna systems.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=520>)

**413-521. Residential Design & Estimating. (0.75 Credits)**

Review the basics of electrical blueprints and National Electrical Code requirements for residential areas during this apprenticeship course. Use various methods to develop a residential power plan and residential estimates.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=521>)

**413-522. Ind Des & Est. (0.75 Credits)**

Explore the electrical code requirements for commercial and industrial areas. Develop and calculate the power plan and distribution for an application. Discuss various methods of estimating used during an apprenticeship.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=522>)

**413-523. Industrial Data Communication. (2 Credits)**

Apprentices will explore Serial communications, network communications, Ethernet, TCP/IP, industrial fieldbusses, and industrial wireless communications.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=523>)

**413-524. IE DC Circuit Analysis. (1.5 Credits)**

Gain an introduction to fundamental concepts and computations in DC electricity. Explore circuit analysis and practice problem-solving skills needed to maintain modern industrial electric systems. Learn metering and safe use of measuring devices.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=524>)

**413-525. IE AC Circuit Analysis. (1.5 Credits)**

Explore the basic concepts of alternating current, including circuit analysis and the problem-solving skills needed to maintain modern industrial electric systems.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=525>)

**413-526. NEC Overview. (1 Credit)**

Gain an introduction to the layout and purpose of the National Electrical Code (NEC). Learn proper methodology to research a code question and correctly interpret what you are reading. Research the structure of the NEC, and define the requirements of the code that are common to all electrical installations.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=526>)

**413-527. IE Transformers. (1.5 Credits)**

Explore topics including three-phase AC fundamentals, single-phase transformers and three-phase transformers.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=527>)

**413-528. IE Motors and Generators. (1.5 Credits)**

Explore motors, motor controls and generators.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=528>)

**413-529. NEC In Depth. (1 Credit)**

Study the National Electrical Code (NEC) in depth, including transformers, motors and generators.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=529>)

**413-533. IE Raceways Control Drawings. (1.5 Credits)**

Explore conduit fabrication and related trade skills. Apply trade math including fractions, decimals and geometry to various situations. Examine offsets, bends, saddles and other fabrication techniques, and practice using hand power equipment through hands-on lab projects. Explore basic motor control principles and concepts including control diagrams and electrical theories, and become familiar with devices and components including electromechanical and solid-state equipment. Learn to identify and apply safety requirements, and discuss National Electrical Code (NEC) calculations.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=533>)

**413-534. IE Electronics. (1.5 Credits)**

Gain skills and knowledge for troubleshooting basic solid-state devices and circuits. Investigate the construction, identification and operating characteristics of solid-state devices. Build test circuits, gather and analyze data, follow safety procedures and apply methods for locating defective components. Practice replacing printed circuit board components, and examine the effect of temperature on the operation of solid-state devices.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=534>)

**413-535. NEC NFPA 70 and 79. (1 Credit)**

Build on previous code courses, exploring the layout of National Fire Protection Association (NFPA) 70 and gaining an introduction to NFPA 79. Become familiar with the supplemental information provided by NFPA 79 for industrial machinery.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=535>)

**413-536. IE Electromechanical Control 1. (2 Credits)**

Gain an understanding of the fundamentals of electric motor control. Learn to recognize and draw the basic symbols, the language of motor control, and learn how to apply these symbols into the current industrial format. Learn how to draw and read ladder and wiring diagrams. Explore the logic used in motor control, and apply this logic in order to correctly interpret, design and wire control circuits.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=536>)

**413-537. IE Electromechanical Control 2. (2 Credits)**

Build on IE Electromechanical Control 1, and examine motor controls and sensors applicable to the industrial electrician trade.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=537>)

**413-538. IE Variable Speed Drives 1. (2 Credits)**

Explore topics including variable speed drives and electronics.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=538>)

**413-539. IE Variable Speed Drives 2. (2 Credits)**

Build on IE Variable Speed Drives 1, and explore topics including variable speed drives and electronics.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=539>)

**413-540. IE PLC 1. (1.5 Credits)**

Explore topics including programmable logic controllers.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=540>)

**413-541. IE PLC 2. (1.5 Credits)**

Build on IE PLC 1, and explore topics including programmable logic controllers.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=541>)

**413-542. Ind Elec PLC 1. (2 Credits)**

Study programmable logic controllers (PLC) using Allen-Bradley PLCs, RSLogix 500 series related to basics and start up, PLC wiring, ladder diagram networks and basic programming.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=542>)

**413-543. Ind Elec PLC 2. (2 Credits)**

Explore the basic principles of Allen-Bradley's RSLogix 5000. In addition to controller operation, specific topics include an introduction to bit logic, timer, counter, math, data move, and program control instructions, event sequencing, application development, the applicable skills, and theory for Ethernet industrial communication networks used on automated systems.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=543>)

**413-551. IE Raceways & Ctrl Drawings. (1 Credit)**

Explore conduit fabrication and related trade skills. Apply trade math including fractions, decimals and geometry to various situations. Examine offsets, bends, saddles and other fabrication techniques, and practice using hand power equipment through hands-on lab projects. Explore basic motor control principles and concepts including control diagrams and electrical theories, and become familiar with devices and components including electromechanical and solid-state equipment. Learn to identify and apply safety requirements, and discuss National Electrical Code (NEC) calculations.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=551>)

**413-552. Ind Elec Electronics. (1 Credit)**

Gain skills and knowledge for troubleshooting basic solid-state devices and circuits. Investigate the construction, identification and operating characteristics of solid-state devices. Build test circuits, gather and analyze data, follow safety procedures and apply methods for locating defective components. Practice replacing printed circuit board components, and examine the effect of temperature on the operation of solid-state devices.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=552>)

**413-561. Blueprint for Electricians. (1 Credit)**

Become familiar with a commercial project using a complete set of blueprints.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=561>)

**413-781. Intro Elect Theory/DC Safety. (2 Credits)**

Course competencies include an introduction to the trade, electrical codes and safety. In addition, DC theory is applied to electrical circuits, devices, and components. DC circuit calculations help develop trade math skills. This course aligns with the first half of the NCCER level 1 curriculum for construction electricians.

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=781>)

**413-782. Wiring, Blueprt Rdg, Intro NEC. (2 Credits)**

Course explores electrical codes and safety. In addition basic wiring principles and print reading are introduced to help build trade skills for ABC electrician apprentices. Use of test equipment used by the trade is included. This course aligns with the second half of the NCCER level 2 curriculum for construction electricians.

Prerequisites: (413-781 with a minimum grade of C or 413-511 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=782>)

**413-783. Electric, Motor, Conduit, Light. (2 Credits)**

Course competencies include a review of AC electrical theory, circuits and devices. Apprentices will also examine basic lighting systems, and develop skills bending and fabricating conduit. Course includes an introduction to motors and motor installations. Electrical safety work practices and codes are reinforced. This course aligns with the first half of the NCCER level 2 curriculum for construction electricians.

Prerequisites: (413-512 with a minimum grade of C or 413-782 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=783>)



**413-784. Ground, Overcurrent, Terminate. (2 Credits)**

Course competencies include conductor terminations and splices, methods and practices for installing electrical devices, and applying NEC requirements to various installations. Apprentices will also be introduced to grounding and bonding, overcurrent protective devices, and cable trays. Electrical safety work practices and applicable electrical codes will be reinforced. This course aligns with the second half of the NCCER level 2 curriculum for construction electricians.

Prerequisites: (413-783 with a minimum grade of C or 413-513 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=784>)

**413-785. Intermed Wiring Application. (2 Credits)**

Course competencies address load calculations, conductor selection and sizing, intermediate wiring applications, and the NEC requirements and installation procedures for various types of electrical equipment. Electrical safety work practices and codes will be reinforced in this course. Equipment requirements for hazardous locations are discussed. This course aligns with the first half of the NCCER level 3 curriculum for construction electricians.

Prerequisites: (413-784 with a minimum grade of C or 413-514 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=785>)

**413-786. Motor Appl Controls, Installs. (2 Credits)**

Course competencies examine selecting and wiring transformers, applying NEC requirements and installation requirements for commercial electrical services, and motor controls. Apprentices will also explore low voltage systems and components. Electrical safety work practices and codes are reinforced in this course. This course aligns with the second half of the NCCER level 3 curriculum for construction electricians.

Prerequisites: (413-785 with a minimum grade of C or 413-515 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=786>)

**413-787. Emergency & Security Systems. (2 Credits)**

Course examines back-up power equipment, special communication systems, wiring devices, and installation requirements for emergency and security systems. Apprentices will explore electric generators and energy storage, fire alarms, DACS systems and related equipment. Electrical safety work practices and codes reinforced in this course. This course aligns with the first half of the NCCER level 4 curriculum for construction electricians.

Prerequisites: 413-786 with a minimum grade of C

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=787>)

**413-788. Systems Controls. (2 Credits)**

Course examines solid state controls, PLC hardware, starters, variable frequency drives and electrical equipment associated with system control. NEC requirements for HVAC, heat tracing, medium voltage equipment, and special occupancies are included. Apprentices will also relate motor operations to maintenance and replacement job tasks. This course aligns with the second half of the NCCER level 4 curriculum for construction electricians.

Prerequisites: (413-787 with a minimum grade of C or 413-517 with a minimum grade of C)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=788>)

**413-789. Adv Elec Topic 1 ABC Elec Appr. (2 Credits)**

Course examines solid state controls, PLC hardware, starters, variable frequency drives and electrical equipment associated with system control. NEC requirements for HVAC, heat tracing, medium voltage equipment, and special occupancies are included. Apprentices will also relate motor operations to maintenance and replacement job tasks. This course aligns with the second half of the NCCER level 4 curriculum for construction electricians.

Prerequisites: (413-788 with a minimum grade of C- or 413-518 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=789>)

**413-790. Adv Elec Topic 2 ABC Elec Appr. (2 Credits)**

Course examines solid state controls, PLC hardware, starters, variable frequency drives and electrical equipment associated with system control. NEC requirements for HVAC, heat tracing, medium voltage equipment, and special occupancies are included. Apprentices will also relate motor operations to maintenance and replacement job tasks. This course aligns with the second half of the NCCER level 4 curriculum for construction electricians.

Prerequisites: (413-789 with a minimum grade of C- or 413-519 with a minimum grade of C-)

See sections of this course (<http://www.wctc.edu/academics/programs-courses/course-search/course-search-listing.php?code=413&num=790>)