

## **NCCER ELECTRICAL CURRICULUM**

*The following is a brief description of subjects contained in all five levels of the electrical program as well as the core curricula that all level one students are expected to pass. The curriculum covers four years with and optional fifth year to address "Advanced Electrical Topics"*

*This curriculum is for electrical apprentices and assumes you are already employed by an electrical firm! If that is not the case you may apply to become an apprentice with the Cornhusker Training Trust by clicking on this link <http://www.abcnebraska.org/Graduation/Education.aspx>*

### **CORE CURRICULUM**

*The core curricula provides a basic introduction to construction work for all crafts. The core curricula is an internet based self-study course and is not taught in the class room like electrical levels 1-5.*

#### **Basic Safety**

Explains the safety obligations of workers, supervisors, and managers to ensure a safe workplace. Discusses the causes and results of accidents and the dangers of rationalizing risk. Reviews the role of company policies and OSHA regulations in maintaining a safe work place. Introduces common job-site hazards and protections such as lockout/tagout, personal protective equipment (PPE), and HazCom.

#### **Introduction to Construction Math**

Reviews basic mathematical functions such as adding, subtracting, dividing, and multiplying whole numbers, fraction, and decimals, and explains their applications to the construction trades. Explains decimal-fraction conversions and the metric system using practical examples. Also reviews basic geometry as applied to common shapes and forms.

#### **Introduction to Hand Tools**

Introduces trainees to hand tools that are widely used in the construction industry, such as hammers, saws, levels, pullers, vises and clamps. Explains the specific applications of each tool and shows how to use them properly. Also discusses important safety and maintenance issues related to hand tools.

#### **Introduction to Power Tools**

Provides detailed descriptions of commonly used power tools such as drills, saws, grinders, and sanders. Reviews applications, proper use, safety, and maintenance. Many illustrations show power tools used in on-the-job settings.

#### **Introduction to Construction Drawings**

Covers construction drawings, components, and symbols. Discusses different types of drawings and describes how to interpret and use drawing dimensions.

#### **Basic Rigging**

Explains how ropes, chains, hoist, loaders, and cranes are used to move material and equipment from one location to another on a job site. Describes inspection techniques and load-handling safety practices. Also reviews American National Standards Institutes (ANSI) hand signals.

#### **Basic Communication Skills**

Provides trainees with techniques for communicating effectively with co-workers and supervisors. Includes practical examples that emphasize the importance of verbal and written information and instructions on the job. Also discusses effective telephone and e-mail communication skills.

#### **Basic Employability Skills**

Identifies the roles of individuals and companies in the construction industry. Introduces trainees to critical thinking and problem solving skills and computer systems and their industry applications. Also review effective relationship skills, effective self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse.

## ELECTRICAL LEVEL ONE

### **Orientation to the Trade**

Provides an overview of the electrical trade and discusses the career paths available to electricians.

### **Electrical Safety**

Covers safety rules and regulations for electricians. Teaches the necessary precautions to take for various electrical hazards found on the job. Also teaches the OSHA mandated lockout/tagout procedure.

### **Introduction to Electrical Circuits**

Offers a general introduction to electrical concepts used in Ohm's law applied to DC series circuits. Includes atomic theory, electromotive force, resistance, and electric power equations.

### **Electrical Theory**

Introduces series, parallel, and series-parallel circuits. Covers resistive circuits, Kirchhoff's voltage and current laws, and circuit analysis.

### **Introduction to the National Electrical Code**

Provides a navigational roadmap for using the NEC. Introduces the layout of the NEC and the types of information found within the code book. Allows trainees to practice finding information using an easy-to-follow procedure.

### **Device Boxes**

Covers the hardware and systems used by an electrician to mount and support boxes, receptacles, and other electrical components. Covers NEC fill and pull requirements for the device, pull and junction boxes under 100 cubic inches.

### **Hand Bending**

Provides an introduction to conduit bending and installation. Covers the techniques for using hand-operated and step conduit benders as well as cutting, reaming and threading conduit.

### **Raceways and Fittings**

Introduces the types and applications of raceways, wire ways and ducts. The appropriate NEC requirements are stressed.

### **Conductors and Cables**

Focuses on the types and applications of conductors and proper wiring techniques. Stresses the appropriate NEC requirements.

### **Basic Electrical Construction Drawings**

Focuses on electrical prints, drawings, and symbols. Teaches the types of information that can be found on schematics, one-lines, and wiring diagrams.

### **Residential Electric Services**

Covers the electrical devices and wiring techniques common to residential construction and maintenance. Training to practice making service calculations. Stresses the NEC requirements.

### **Electrical Test Equipment**

Focuses on proper selection, inspection, and use of common electrical test equipment, including voltage testers, clamp-on ammeters, ohmmeters, millimeters, phase/motor rotation testers, and data recording equipment. Also covers safety precautions and meter category ratings.

## ELECTRICAL LEVEL TWO

### **Alternating Current**

Focuses on forces that are characteristic of alternating -current systems and the application of Ohm's Law to AC circuits.

**Motors: Theory and Application**

Covers AC and DC motors including the main parts, circuits, and connections.

**Electric Lighting**

Introduces principles of human vision and the characteristics of light. Focuses on the handling and installation of various types of lamps and lighting fixtures.

**Conduit Bending**

Covers all types of bends in all sizes of conduit up to 6 inches. Focuses on mechanical, hydraulic, and electrical benders.

**Pull and Junction Boxes**

Explains how to select and size pull boxes, junction boxes, and handholes.

**Conductor Installations**

Covers the transportation, storage, and set-up of cable reels; methods of rigging; and procedures for complete cable pulls in raceways and cable trays.

**Cable Tray**

Focuses on NEMA and NEC installation requirements for cable tray, including modifications and cable installations.

**Conductor Terminations and Splices**

Describes methods of terminating and splicing conductors of all types and sizes, including preparing and taping of conductors.

**Grounding and Bonding**

Focuses on the purpose of grounding and bonding electrical systems. Thoroughly covers *NEC®* requirements.

**Circuit Breakers and Fuses**

Describes fuses and circuit breakers along with their practical application. Covers short-circuit calculation.

**Control Systems and Fundamental Concepts**

Gives basic descriptions of various types of contactors and relays along with their practical applications.

### ELECTRICAL LEVEL THREE

**Load Calculations-Branch Feeders and Circuits**

Introduces the industry standards for electrical work, including the topics of branch circuits, rating and derating, and various types of residential and commercial electrical loads.

**Conductors Selection and Calculations**

Covers the types of conductors used in wiring systems, including insulation, current-carrying capacity, and temperature ratings.

**Practical Applications of Lighting**

Describes specific types of incandescent, fluorescent, and HID lamps, as well as ballasts. Also covers troubleshooting and various types of lighting controls.

**Hazardous Locations**

Presents the *NEC®* requirements for equipment installed in hazardous locations.

**Overcurrent Protection**

Stresses the use a variety of overcurrent protection devices, including circuit breakers and fuses, in all types of electrical systems.

**Distribution Equipment**

Discusses switchboards and switchgear, including installation, grounding, and maintenance requirements. This module includes blueprints.

**Transformers**

Discusses transformer types, construction, connections, protection, and grounding.

**Commercial Electrical Services**

Covers the components, installation considerations, and *NEC*<sup>®</sup> requirements for commercial services.

**Motor Calculations**

Covers calculations required to size conductors and overcurrent protection for motor applications.

**Voice, Data, and Video**

Covers installation, termination, and testing of voice, data, and video cabling systems.

**Motor Controls**

Provides information on selecting, sizing, and installing motor controllers. Also covers control circuit pilot devices and basic relay logic.

**ELECTRICAL LEVEL FOUR****Load Calculations-Feeder and Services**

Describes basic calculation procedures and calculations for commercial and residential applications.

**Health Care Facilities**

Covers the installation of electric circuits in health care facilities, including the requirements for life safety and critical circuits.

**Standby and Emergency Systems**

Explains NEC installation requirements for electric generators and storage.

**Basic Electronic Theory**

Explains the function and operation of basic electronic devices, including semi conductors, diodes, rectifiers, and transistors.

**Fire Alarm Systems**

Covers the fire alarm control units, Digital Alarm Communicator Systems (DACS), installation wiring for alarm initiating and notification devices, and alarm system maintenance.

**Specialty Transformers**

Covers various types of transformers and their applications. Also provides information on selecting, sizing, and installing these devices.

**Advanced Controls**

Explains applications and operating principles of solid-state controls, reduced-voltage starters, and adjustable frequency drives. Also covers basic troubleshooting procedures.

**HVAC Controls**

Provides a basic overview of HVAC systems and their controls. Stresses electrical troubleshooting and NEC requirements.

**Heat Tracing and Freeze Protection**

Covers various heat tracing systems along with their application and installation requirements.

**Motor Operation and Maintenance**

Covers motor cleaning, testing, and preventive maintenance. Also describes basic troubleshooting procedures.

### **Medium-Voltage Terminations/Splices**

Offers an overview of the *NEC*® and cable manufacturers' requirements for medium-voltage terminations and splices.

### **Special Locations**

Describes *NEC*® requirements for selecting and installing equipment, enclosures, and devices in special locations including places of assembly, theaters, carnivals, agricultural buildings, marinas, temporary installations, wired partitions and swimming pools.

### **Fundamentals of Crew Leadership**

The course covers basic leadership skills and explains different leadership styles, communication, delegating, and problem solving. Job-site safety and the crew leader's role in safety are discussed, as well as project planning, scheduling, and estimating. Includes performance tasks to assist the learning process.

## **OPTIONAL LEVEL FIVE - ADVANCED ELECTRICAL TOPICS**

*This address much of the technology in emerging fields—such as wireless, integrated, and voice and data systems. This is material drawn from **Electronic Systems Technician** and **Instrumentation**.*

### **Cable Selection**

Provides an overview of the types of cable used for low-voltage installations. Also covers the methods used to select the proper size and type of cable for a typical installation.

### **Wire and Cable Terminations**

Provides information and instructions for selecting, installing, and testing connectors and other terminating devices on cables used in low-voltage work, including telecommunications, video and audio, and fiber optics.

### **CCTV Systems**

Describes the installation and configuration of closed circuit TV systems for small, medium, and large facilities. Explains various equipment, including cameras, lenses, remote-positioning, video recording, and transmission. Covers the roles of the internet and digital technologies. Introduces test and troubleshooting equipment.

### **Access Control Systems**

Introduces access control systems, including applications, door locking systems, readers, biometrics, and controllers. Emphasizes installation practices as well as building and electrical codes.

### **Buses and Networks**

Details procedures for connecting computers and components, including network connections. Provides information on connecting controls and equipment in a control system, and explains how data is transferred between the nodes in a network.

### **Fiber Optics**

Introduces the types of equipment and methods used in fiber-optic cable installation.

### **Programmable Logic Controllers**

Introduces the application of PLCs in industrial process control, as well as the binary numbering system used in computer-based control. Covers components of PLCs, including power supplies, I/O modules, processor modules, types of communication bus, and memory.

### **Broadband Systems**

Describes the major elements of head end design for specialized television systems, including CATV, SMATV, and MATV systems. Explains receivers, modulators, amplification, and distribution devices. Explains proper signal levels, cable attenuation, insertion loss, and acceptable carrier-to-noise levels. Covers common test equipment and troubleshooting procedures.

## **Distributed Control Systems**

Describes how DCS was developed by combining the technologies of single loop control, direct digital control, and supervisory control. Covers DCS basic hardware requirements, how control loops are implemented into a DCS, types of data transmission used in DCS, communication protocols, and human interfaces.

## **Intrusion Detection Systems**

Describes devices such as sensors, notification, control panels, and programming used in intrusion detection security systems. Covers system design and installation guidelines, wiring, testing, and troubleshooting. Emphasizes codes and standards.

## **Audio Systems**

Introduces and explains audio system components, including input sources, amplifiers, signal processing equipment, and output equipment. Describes power requirements, cabling options, system configuration, and basic design considerations. Reviews common test equipment used for installation and troubleshooting.

## **Overview of Nurse Call and Signaling Systems**

Presents an overview of nurse call and signaling systems as found in hospitals and other health-care facilities. Covers basic emergency call and duress system requirements based on facility type. Identifies installation requirements based on UL and other building code specifications.



### The NCCER Program

NCCER (*National Center for Construction Education & Research*) maintains a portable and widely recognized credentialing and certification system through its Registry. This Registry assures portability of skills by providing transcripts, certificates and wallet cards to students who successfully complete the NCCER Curriculum through an accredited sponsor. These valuable industry credentials benefit students as they seek employment and build their careers.

NCCER has developed a consistent program of accreditation, instructor certification, standardized curriculum, registry, assessment and certification, which is a key element in developing a skilled workforce of craft professionals.

NCCER is the accrediting body for the industry and establishes the benchmark for quality training and assessments. By partnering with industry and academia, NCCER has developed a system for program accreditation that is similar to those found in institutions of higher learning. This process ensures that students receive quality training based on uniform standards and criteria.

The NCCER Curriculum In cooperation with publishing partner Pearson, has developed and publishes a world-class curriculum created by “Subject Matter Experts” representing contractors and schools from around the country. “Subject Matter Experts” ensure exceptional training programs that meet or exceed national industry standards. The NCCER Curriculum, which includes more than 60 craft areas, is taught worldwide by contractors, associations, construction users, and secondary and post-secondary schools. In addition, multiple state Departments of Education recognize the curriculum along with the U. S. Dept. of Labor - Office of Apprenticeship.