# ELECTRICAL TECHNOLOGY - ELECTRICIAN

## DIPLOMA – 74 CREDITS

## About this program

This diploma program is designed to prepare the student to build, install, maintain and repair electrical systems that provide heat, light or power for residential, commercial and industrial structures. Courses provide students with a mix of theory and hands-on application in classroom and lab settings and at job sites. This comprehensive program includes maintenance of electrical equipment, wiring methods, blueprint reading, material selection, programmable controllers and National Electric Code.

## Program outcomes

1. Exhibit safety practices and procedures.
2. Interpret the National Electrical Code.
3. Apply principles necessary to install and control electrical systems in residential, commercial and industrial buildings.
4. Calculate electrical quantities.
5. Interpret blueprints.
6. Demonstrate professionalism and related soft skills.
7. Interpret electrical schematic and wiring diagrams.

## Curriculum overview

| Crds | Requirement type |
|---|---|
| 74 | Required courses |
| 74 | **Total** |

**Developmental courses note:** A student may be required to enroll in developmental courses in reading, writing and math. A student's scores on the Accuplacer assessment will determine enrollment in developmental courses. The purpose of developmental courses is to prepare students for the demands of a college-level curriculum. *Credits may vary.*

**Accreditation:** Minnesota State Community and Technical College is accredited by the Higher Learning Commission, a regional accreditation agency recognized by the U.S. Department of Education. The Higher Learning Commission 230 South LaSalle Street, Suite 7-500 Chicago, IL 60604-1411 http://www.ncahigherlearningcommission.org Phone: 312.263.0456 / 800.621.7440

# Curriculum requirement details

## Required courses

| Course | Crds |
|---|---|
| ELEC1100 - Electrical Safety | 1 |
| ELEC1102 - Introduction to Electric Circuit Theory | 4 |
| ELEC1104 - Introduction to National Electrical Code | 2 |
| ELEC1107 - Introduction to Residential Wiring | 3 |
| ELEC1108 - Electrical Circuit Theory | 4 |
| ELEC1110 - Electric Motors and Generators | 4 |
| ELEC1112 - Residential Wiring | 3 |
| ELEC1114 - National Electrical Code | 2 |
| ELEC1116 - Conduit/Tool Applications | 2 |
| ELEC1118 - Electrical Services | 3 |
| ELEC1122 - Introduction to Electrical Materials | 1 |
| ELEC1124 - Introduction to Electrical Blueprint Reading | 2 |
| ELEC1130 - Electrical Blueprints | 3 |
| ELEC2202 - Heating/Cooling Controls | 3 |
| ELEC2205 - Introduction to Commercial Wiring | 3 |
| ELEC2206 - Introduction to Motor Control Applications | 3 |
| ELEC2208 - Programmable Logic Controllers | 2 |
| ELEC2211 - Electronic Motor Control | 3 |
| ELEC2212 - Commercial Wiring | 3 |
| ELEC2214 - Industrial Wiring | 2 |
| ELEC2216 - Motor Control Application | 3 |
| ELEC2222 - Advanced Programmable Logic Controllers | 3 |
| ELEC2225 - Transformers | 2 |
| ELEC2230 - Electrical Building Information Modeling | 2 |
| ELEC2238 - Low Voltage Wiring | 2 |
| ELEC2248 - Code Applications | 2 |
| ELEC2250 - Special Topics/Projects | 2 |
| HLTH1122 - CPR-First Aid | 1 |
| MATH1000 - Technical Mathematics | 3 |
| PDEV1102 - Contemporary Career Search | 1 |

## Other requirements or restricted electives

# Course summaries

**ELEC1100 - Electrical Safety** ..... ***(1 credits)***
This course provides students with an understanding of occupational safety practices and requirements associated with working in the electrical industry. It also covers the purpose and enforcement of general safety rules.

**ELEC1102 - Introduction to Electric Circuit Theory** ..... ***(4 credits)***
This introductory course provides the student with knowledge of electrical theory including atomic structure, Ohm's law, series circuits, parallel circuits, complex circuits and sine wave principles as related to the National Electrical Code.

**ELEC1104 - Introduction to National Electrical Code** ..... ***(2 credits)***
This course provides the student with an introduction to the National Electrical Code. The student develops basic skills and understanding of the National Electrical Code and how it applies to electrical applications in the field.

**ELEC1107 - Introduction to Residential Wiring** ..... ***(3 credits)***
This course provides a fundamental technical understanding of residential wiring. Basic wiring skills for residential occupancies will be practiced in lab settings while applying National Electrical Code standards.

**ELEC1108 - Electrical Circuit Theory** ..... ***(4 credits)***
This course provides the student with an understanding of complex AC circuits, single-phase and three-phase circuit connections, transformer principles and calculations.

***Prerequisites:***

- ELEC1102

**ELEC1110 - Electric Motors and Generators** ..... ***(4 credits)***
This course provides a fundamental understanding of electric motor and generator theory and basic skills. This course includes types, construction, operation, installation and maintenance of electric motors and generators.

***Prerequisites:***

- ELEC1102

**ELEC1112 - Residential Wiring** ..... ***(3 credits)***
This course provides students with expanded technical understanding and skills necessary for residential wiring. Students will be provided with experience for installations common to residential structures including general receptacles, lighting and designated circuit layout and installation.

***Prerequisites:***

- ELEC1107

**ELEC1114 - National Electrical Code** ..... ***(2 credits)***
This course provides students with an understanding of National Electrical Code articles related to overcurrent protection, raceways, special systems, panelboards, motors, compressors, transformers and the State Electrical Act.

***Prerequisites:***

- ELEC1104

**ELEC1116 - Conduit/Tool Applications** ..... ***(2 credits)***
Numerous applications and skills will be developed in this course including bending, threading and installation of various types of conduit. This course also provides a review of the operation and safety of both hand and power tools used in the construction electricity field.

***Prerequisites:***

- ELEC1100

**ELEC1118 - Electrical Services** ..... ***(3 credits)***
This course covers requirements and installation of service entrance equipment. Topics include service materials, installation procedures, meters, service and conduit sizes, panel types, bonding, grounding and overcurrent protection.

***Prerequisites:***

- ELEC1104

**ELEC1122 - Introduction to Electrical Materials** ..... ***(1 credits)***
This course provides the student with an introduction to the electrical material used in industry. The student develops basic skills and understanding of the material and how it applies to electrical applications in the field.

**ELEC1124 - Introduction to Electrical Blueprint Reading** ..... ***(2 credits)***
This course provides the student with a working knowledge of residential blueprints and specifications. The student gains an understanding of blueprints, then interprets and applies this knowledge to the electrical industry.

**ELEC1130 - Electrical Blueprints** ..... ***(3 credits)***
The student will learn to read commercial blueprints with an emphasis on electrical circuitry including lighting, power, service, feeders and special systems. The course also introduces the student to computer-aided design (CAD) drawings.

***Prerequisites:***

- ELEC1124

**ELEC2202 - Heating/Cooling Controls** ..... ***(3 credits)***
This course introduces basic electric heating, gas, oil, heat pump and cooling system installation and control. Topics include installing wiring for heating and air conditioning systems, replacing controls, measuring instruments and schematic interpretation.

***Prerequisites:***

- ELEC1107

**ELEC2205 - Introduction to Commercial Wiring** ..... ***(3 credits)***
This course examines the material and design aspects of commercial wiring. Topics include raceways, boxes, design requirements for conduit layouts, circuit overcurrent protection and lighting.

***Prerequisites:***

- ELEC1104
- ELEC1122

**ELEC2206 - Introduction to Motor Control Applications** ..... ***(3 credits)***
This course provides an understanding of motor control symbols, line diagrams, contractors, starters and operating circuits. Lab procedures demonstrate components, circuitry and operation learned in theory. Measured data is recorded and interpreted.

***Prerequisites:***

- ELEC1108
- ELEC1110

**ELEC2208 - Programmable Logic Controllers** ..... ***(2 credits)***
This course covers the theory, operation, installation, hardware, software and practical applications of programmable logic controllers (PLC). Basic PLC programming techniques for counters, timers and sequencers will be presented.

**ELEC2211 - Electronic Motor Control** ..... ***(3 credits)***
This course provides application of basic theory and operation to electronic motor control including semi-conductors, rectifiers, regulators and amplifiers.

***Prerequisites:***

- ELEC1108

**ELEC2212 - Commercial Wiring** ..... ***(3 credits)***
This course covers materials and design aspects of commercial wiring, in particular lighting and fuse applications. Topics include lighting and lamp installation and selection, fuse selection, special outlets, load schedule, short circuit calculations and emergency illumination.

***Prerequisites:***

- ELEC2205

**ELEC2214 - Industrial Wiring** ..... ***(2 credits)***
This course covers the installation methods and materials used in industrial wiring. Topics include transformers, busways, motor installation, industrial metering, overcurrent system coordination, ground detection, grounding systems, surge protection, distribution, special systems and industrial hazardous locations, and the study of the National Electrical Code relating to these topics.

***Prerequisites:***

- ELEC1114

**ELEC2216 - Motor Control Application** ..... ***(3 credits)***
This course provides an advanced understanding of circuits controlling motors. Topics include jogging, braking, plugging, reduced voltage starting, phase loss protection, latching relays, time delay relays and safety requirements. Lab procedures demonstrate components, circuitry and operation learned in theory. Measured data is recorded and interpreted.

***Prerequisites:***

- ELEC2206

**ELEC2222 - Advanced Programmable Logic Controllers** ..... ***(3 credits)***
This course presents practical applications of Advanced Programmable Logic Controllers (APC) with emphasis on advanced programming techniques and analog modules, input devices and hands-on wiring of Programmable Logic Controller (PLC) circuits. PLC programs are created and installed for operation of actual electrical equipment.

***Prerequisites:***

- ELEC2208

**ELEC2225 - Transformers** ..... ***(2 credits)***
This course covers the concepts of transformer operation. Single-phase and three-phase (polyphase) transformer operation and installation methods are explored. Included in the course are the following topics: transformer operation, transformation relationships, transformer losses, transformer types, transformer testing, series and parallel operation, connections, instrument transformers and maintenance procedures. National Electrical Code requirements for transformer installations are developed and utilized.

***Prerequisites:***

- ELEC1108

**ELEC2230 - Electrical Building Information Modeling** ..... ***(2 credits)***
This course will provide the student with an introduction to Building Information Modeling (BIM) concepts, terminology and application of best practices being used in the electrical industry.

***Prerequisites:***

- ELEC1130

**ELEC2238 - Low Voltage Wiring** ..... ***(2 credits)***
This course provides students with an understanding of installation procedures and National Electrical Code (NEC) requirements for coax, telephone, fire alarm, security, fiber optic, cat 4, cat 5 and other low-voltage wiring systems.

**ELEC2248 - Code Applications** ..... ***(2 credits)***
This course applies the principles of the National Electrical Code to job-specific situations.

***Prerequisites:***

- ELEC1104
- ELEC1114

**ELEC2250 - Special Topics/Projects** ..... ***(2 credits)***
The student works with an advisor and instructor to develop a contract with specific goals in areas deemed applicable to the construction electricity industry and the student's career plan. This opportunity may be limited by conditions such as instructor/lab/material availability.

**HLTH1122 - CPR-First Aid** ..... ***(1 credits)***
This course teaches basic life support using American Heart Association or American Red Cross guidelines and first aid using American Academy of Orthopaedic Surgeons(AAOS) or American Red Cross guidelines.

**MATH1000 - Technical Mathematics** ..... ***(3 credits)***
This course presents basic mathematical topics as they are applied in a technical program. The course includes a review of basic mathematical operations and continues with the development of algebraic and trigonometric skills in a technical setting. Most concepts will be applied through course-specific problems. This course is not an MnTC Goal Area 4 mathematics course, nor does it prepare students for taking an MnTC Goal Area 4 mathematics course.

**PDEV1102 - Contemporary Career Search** ..... ***(1 credits)***
This course covers such contemporary career topics as employer expectations, job market trends and networking, and various aspects of the employment search process including legal and ethical issues. To apply their knowledge of the employment process, students develop resumes, letters and applications, as well as identify and use effective interviewing techniques. This course emphasizes a comprehensive knowledge of career processes that will serve students throughout their working lives.

# ELECTRICAL TECHNOLOGY - ELECTRICIAN

## DIPLOMA – 74 CREDITS

Program Plan — "Primary"

Locations: Wadena

### 1st Fall Term (16 credits)

**Courses**

| Course | Crds |
|---|---|
| ELEC1100 - Electrical Safety | 1 |
| ELEC1102 - Introduction to Electric Circuit Theory | 4 |
| ELEC1104 - Introduction to National Electrical Code | 2 |
| ELEC1107 - Introduction to Residential Wiring | 3 |
| ELEC1122 - Introduction to Electrical Materials | 1 |
| ELEC1124 - Introduction to Electrical Blueprint Reading | 2 |
| MATH1000 - Technical Mathematics | 3 |

### 1st Spring Term (17 credits)

**Courses**

| Course | Crds |
|---|---|
| ELEC1108 - Electrical Circuit Theory | 4 |
| ELEC1110 - Electric Motors and Generators | 4 |
| ELEC1112 - Residential Wiring | 3 |
| ELEC1114 - National Electrical Code | 2 |
| ELEC1130 - Electrical Blueprints | 3 |
| PDEV1102 - Contemporary Career Search | 1 |

### 1st Summer Term (6 credits)

**Courses**

| Course | Crds |
|---|---|
| ELEC1116 - Conduit/Tool Applications | 2 |
| ELEC1118 - Electrical Services | 3 |
| HLTH1122 - CPR-First Aid | 1 |

### 2nd Fall Term (18 credits)

**Courses**

| Course | Crds |
|---|---|
| ELEC2202 - Heating/Cooling Controls | 3 |
| ELEC2205 - Introduction to Commercial Wiring | 3 |
| ELEC2206 - Introduction to Motor Control Applications | 3 |
| ELEC2208 - Programmable Logic Controllers | 2 |
| ELEC2211 - Electronic Motor Control | 3 |
| ELEC2225 - Transformers | 2 |
| ELEC2250 - Special Topics/Projects | 2 |

## 2nd Spring Term (17 credits)

### Courses

| Course | Crds |
|---|---|
| ELEC2212 - Commercial Wiring | 3 |
| ELEC2214 - Industrial Wiring | 2 |
| ELEC2216 - Motor Control Application | 3 |
| ELEC2222 - Advanced Programmable Logic Controllers | 3 |
| ELEC2230 - Electrical Building Information Modeling | 2 |
| ELEC2238 - Low Voltage Wiring | 2 |
| ELEC2248 - Code Applications | 2 |