

Wisconsin Technical College System Program Design

50-413-1 INDUSTRIAL ELECTRICIAN APPRENTICE

Program Information

Program Description

Industrial electricians maintain and repair many different types of electrical equipment. In addition, they modify and install devices such as motors, transformers, generators, controls, instruments, lighting systems, and power distribution. Typical duties of electricians include performing preventive maintenance; replacing units or parts such as wiring, fuses, circuit breakers, coils or switches; measuring, cutting, bending, threading and installing conduits; using volt-ohm meters and oscilloscopes; working from blueprints, drawings and diagrams; making mathematical computations to determine the current carrying capacities of electrical wire and equipment; and troubleshooting AC and DC drives and programmable logic controllers.

Industrial electricians should have manual dexterity, color vision, agility and good health. Electricians must also be able to plan operations and use good judgment in selecting tools and materials. The apprentice should enjoy solving problems, be able to follow through on assignments and be willing to assume responsibility for quality work. The Industrial Electrician Apprentice program encompasses a combination of 8,320 hours of on-the-job training and classroom instruction. The program consists of 720 hours of paid-related instruction.

External Requirements

- NFPA 70, National Electric Code; NFPA 79, Industrial Machinery Standards and Comm. 16
- State Electrical Codes & DSPS licensing requirements (pending)
- Wisconsin Dept. of Workforce Development, Bureau of Apprenticeship Standards Exhibit A Work Processes
- 720 hours of related instruction in four years per Wisconsin BAS. The hours were revised to incorporate the new Green Awareness for E&I Trades module (28 hours) effective beginning in 2012.

Entry Requirements

- Registered Wisconsin Apprentice
- Physical abilities - walking, climbing and working at heights up to 15 feet, lifting 50 lbs., ability to communicate
- Visual abilities: ability to distinguish colors

Program Outcomes

- 1 Apply AC and DC theory to an industrial setting
- 2 Apply the National Electric Code requirements to industrial equipment and facilities
- 3 Apply operational and troubleshooting principles to a transformer installation
- 4 Maintain electric motors and motor controls
- 5 Test solid state electronic system components
- 6 Apply operational and troubleshooting principles to power systems and variable speed drives
- 7 Apply operational and troubleshooting principles to programmable logic controllers and automation equipment

- 8 Apply operational and troubleshooting principles to fluid power systems
- 9 Interpret industrial equipment drawings and electrical prints
- 10 Communicate trade and occupational related information effectively

Program Configurations

50-413-1 IEA Aligned Curriculum Model for 720 Hours & Accelerated First Year of Related Instruction

This is the new aligned curriculum model for related instruction that is effective for the 2013-2014 school year. This program configuration adds the new green awareness module in 2012, and aligns related instruction with employer competencies which were prioritized in 2010. This model illustrates best practices from the WTCS colleges to deliver 720 hours of related instruction to apprentices in 4 years, accelerates the first year coursework, assumes a 16-week semester, and maintains 4 hours per week in class (or the equivalent). The colleges and employers will have flexibility to schedule each of the terms based on local needs.

This model also breaks down the hours for the NEC code course into many short courses to aid in scheduling and to better align code requirements with specific technologies and work processes. The fluid power unit was broken out into separate hydraulics and pneumatics courses in 2012. The Green Awareness for E&I Trades course was added in 2012 following completion of the SAGE project. The Transition to Trainer course may be taken by apprentices anytime during their last year but is shown here in term 10 for reference.

Credits& Hours

Total Credits= 22.50

Total Hours= 720 (plus 8 additional hours for the Transition to Trainer course)

Term 1

Course #	Course Title	Credits & Hours	Course Description
50-413-750	DC Electricity for Industrial Electricians	2.00 72 hours	This course introduces the fundamental concepts of and computations related to DC electricity. Emphasis is placed on circuit analysis and the problem solving skills necessary for the maintenance of modern industrial electric systems. Competencies related to metering and safe use of measuring devices are included.
50-413-751	AC Electricity for Industrial Electricians	2.00 72 hours	This course is designed to introduce the industrial electrical apprentice to the basic concepts of alternating current. Emphasis is placed on circuit analysis and the problem solving skills necessary for the maintenance of modern industrial electric systems.

Term 2

Course #	Course Title	Credits & Hours	Course Description
50-413-773	Safety & Print Reading for Industrial Electricians	0.50 18 hours	This course will acquaint the apprentice with the interpretation of "Prints" (blueprints) and other engineering and manufacturing documentation. The primary focus of the course will be on the basics of prints and how they are used to convey information to technicians. Application of electrical prints from industrial settings will be studied.

50-413-760	Industrial Electrician Transformers	1.00 36 hours	This course is designed to introduce the Industrial Electrician Apprentice to the basic concepts of single and three-phase transformers. The course will cover transformer theory, turns, current and voltage ratios as well as proper connections and use of various transformers.
50-413-761	Industrial Electrician Motors & Generators	1.00 36 hours	This is the first course of 3 courses for industrial electrician apprentices to explore motor controls. This course introduces concepts, terminology, and safety. In addition, this is designed to give the Industrial Electrician Apprentice the knowledge required by industry to maintain electric motors and generators. This course material will cover DC motors and generators, single-phase and three-phase motors, as well as alternators.
50-413-752	Codes for Industrial Electricians 1: Introduction to the NEC	0.50 18 hours	This course introduces the apprentice to the layout and purpose of the National Electric Code. It also strives to teach the apprentice proper methodology to research a code question and correctly interpret what they are reading. Various examples in the textbook and activity sheets help guide the apprentice through this process. Apprentices will research the structure of the National Electric Code and define the requirements of the code that are common to all electrical installations. In addition, apprentices will examine the installation requirements for fire pumps, emergency systems and fire alarms. This is the first course module of 8 dealing with electrical codes applicable to the trade.
50-413-753	Codes for Industrial Electricians 2: OCPD and Electrical Device Installations	0.50 18 hours	In this module of Codes for Industrial Electricians, apprentices will learn how to plan for the installation of overcurrent protection devices and how to select the proper boxes, cabinets and conduits for industrial electrical installations as called for in the NEC and other electrical codes. This is the second of 8 course modules on the NEC.
50-413-756	Codes for Industrial Electricians 5: Article 300, Cords/Cables, and Hazardous Installations	0.50 18 hours	Course five of 8 examines article 300 of the NEC and wiring methods for industrial electrical applications. In addition, apprentices will determine sizing requirements for cords and cables for installations common to industrial facilities. Finally, the course will identify code requirements for equipment installations in hazardous locations.

Term 3

Course #	Course Title	Credits & Hours	Course Description
50-413-762	Industrial Electrician Motor Controls 1	1.00 36 hours	This course will lead you through the fundamentals of electric motor control. You will learn to recognize and draw the basic symbols, the language of motor control, and how to apply these symbols, into current industrial format. You will also learn to draw and read ladder and wiring diagrams. You will be introduced to the logic used in motor control and be required to apply this logic in order to correctly interpret, design, and wire control circuits.
50-413-763	Industrial Electrician Motor Controls 2	1.00 36 hours	This is the second course of 3 and examines motor controls applicable to the industrial electrician trade.

Term 4

Course #	Course Title	Credits &	Course Description
----------	--------------	-----------	--------------------

		Hours	
50-413-764	Industrial Electrician Motor Controls 3	1.00 36 hours	This is the third of three courses examining motor controls applicable to the industrial electrician trade. Applications and assessment activities are intended in this course.
50-413-754	Codes for Industrial Electricians 3: Article 250 Part A	0.50 18 hours	Course three of 8 examines the application of grounding to industrial electrical situations as required by the NEC and other electrical codes.
50-413-755	Codes for Industrial Electricians 4: Article 250 Part B	0.50 18 hours	Course four of 8 on the NEC continues to examine Article 250 and grounding applications for industrial electrical installations. Apprentices will complete their review of this portion of the NEC and examine additional related electrical codes in effect across Wisconsin.

Term 5

Course #	Course Title	Credits & Hours	Course Description
50-413-765	Power Systems & Variable Speed Drives for Industrial Electricians	2.00 72 hours	This course provides the opportunity for students to learn about power systems and variable speed drives (VSD's). Topics include electricity, electronics, power transmissions, motor operations, AC and DC motor drives, servo and stepper drives, peripherals and communication. Apprentices will also explore closed loop control, feedback devices, and drive maintenance and the troubleshooting of VSD's. Course includes lab/shop and classroom lecture-lab hours.

Term 6

Course #	Course Title	Credits & Hours	Course Description
50-413-766	Fluid Power Systems for Industrial Electricians - Pneumatics	0.50 14 hours	This is a pneumatics course customized for industrial electrician apprentices who deal with fluid power systems. This course will relate the basics of pneumatic theory and pneumatic components. Safety and the interrelationship between pneumatic power with electrical control is emphasized.
50-413-767	Fluid Power Systems for Industrial Electricians- Hydraulics	0.50 14 hours	The hydraulics course is customized for Industrial Electricians and relates the basics of hydraulic theory and hydraulic components. Safety and the interrelationship between hydraulic power with electrical control is emphasized.
50-413-772	Green Awareness for the E&I Trades	1.00 28 hours	Green Awareness for the E&I Trades examines new and emerging technologies influenced by green trends which are impacting work processes today and in the future. The course introduces apprentices to green related knowledge and skills. Green topics covered in this course include energy efficiency; energy conservation; changes in state, national and local codes; lighting alternatives; alternative energy generation; energy efficient motors, drives, controllers and equipment; eliminating toxic materials and reducing wastes; and specific 'green' applications for the various trades involved under the E&I trades.

50-413-757	Codes for Industrial Electricians 6: Conductors, Raceways and Data/Communication Cables	0.50 16 hours	Course six of 8 covers the selection of proper conductors and raceways for industrial electrical installations as required by the NEC and other electrical codes. In addition, course competencies will include examining the installation requirements for data and communication cables.
------------	---	------------------	--

Term 7

Course #	Course Title	Credits & Hours	Course Description
50-413-768	Industrial Electrician Solid State Electronics	2.00 72 hours	This course provides the apprentice with the skills and knowledge for troubleshooting basic solid-state devices and circuits. The construction, identification, and operating characteristics of solid-state devices are investigated. The apprentice builds test circuits, gathers and analyzes data, and follows safety procedures. Methods for locating defective components are applied. The replacement of printed circuit board components is performed. Also examined is the effect of temperature on the operation of solid-state devices.

Term 8

Course #	Course Title	Credits & Hours	Course Description
50-413-769	Industrial Electrician Programmable Logic Controllers 1	1.00 36 hours	This course is designed to teach the fundamentals of programmable logic controller and its programming software. The first course of 3 will introduce terminology, concepts, print reading and safety.
50-413-770	Industrial Electrician Programmable Logic Controllers 2	1.00 36 hours	This is the second of 3 courses for industrial electrician apprentices.

Term 9

Course #	Course Title	Credits & Hours	Course Description
50-413-771	Industrial Electrician Programmable Logic Controllers 3	1.00 36 hours	This is the third course of 3 for industrial electrician apprentices. PLC applications and assessment projects are planned.
50-413-758	Codes for Industrial Electricians 7: Motors and Generators	0.50 18 hours	Course seven of 8 reviews the code requirements for the selection of electrical components for typical industrial electrical motor installations. Course module includes sizing of controls, conductors, switches, branches, and more.
50-413-759	Codes for Industrial Electricians 8: Transformers	0.50 18 hours	Course eight of 8 reviews the electrical code requirements which provide for the protection of various industrial transformer installations. Course competencies include developing plans, sizing equipment and components, safety, and references to applicable sections of the NEC.

Term 10

Course #	Course Title	Credits & Hours	Course Description
----------	--------------	-----------------	--------------------

47-455-455	Transition to Trainer: Your Role as a Journey Worker	0.00 8 hours	<p>Apprenticeship training is a collaborative partnership: employer and employee associations, government, and educational institutions each play a part. In reality, most learning takes place through the daily interaction between an apprentice and his/her co-workers. Surveys have shown that the apprentices are least satisfied with the on-the-job portion of their training--particularly the ability of journey level workers and supervisors to pass on their knowledge of the trade.</p> <p>You have already learned to use the tools of your chosen trade. In this workshop you will be introduced to a new set of basic tools--the tools of a jobsite trainer. You will explore the skills that are necessary to be an effective trainer, discover how to deliver hands-on training, and examine the process for giving useful feedback. During the workshop you will build a Training Toolkit to take back to your work on the job.</p>
------------	--	-----------------	---

Wisconsin Technical College System

50-413-750 DC Electricity for Industrial Electricians

Course Outcome Summary

Course Information

Description This course introduces the fundamental concepts of and computations related to DC electricity. Emphasis is placed on circuit analysis and the problem solving skills necessary for the maintenance of modern industrial electric systems. Competencies related to metering and safe use of measuring devices are included.

Total Credits 2.00

Program Outcomes

- 1 Apply AC and DC theory to an industrial setting.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Examine the basic nature of electricity
- 2 Perform basic mathematical functions
- 3 Compare sources of electricity
- 4 Apply units of measure for electrical quantities
- 5 Calculate electrical quantities of voltage, current, resistance, power, and conductance using Ohm's law
- 6 Calculate the voltage, current, resistance, and power dissipation for the series D.C. circuit
- 7 Determine how resistance affects an electrical circuit
- 8 Analyze a resistive series circuit
- 9 Analyze a parallel circuit
- 10 Analyze combination circuits
- 11 Compare conductors and insulators
- 12 Analyze principles of magnetism
- 13 Examine how electromagnetic devices operate
- 14 Examine how motor action relates to the operation of electrical devices

Wisconsin Technical College System

50-413-751 AC Electricity for Industrial Electricians

Course Outcome Summary

Course Information

Description This course is designed to introduce the industrial electrical apprentice to the basic concepts of alternating current. Emphasis is placed on circuit analysis and the problem solving skills necessary for the maintenance of modern industrial electric systems.

Total Credits 2.00

Program Outcomes

- 1 Apply AC and DC theory to an industrial setting.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Apply right angle trigonometry to circuit analysis
- 2 Examine characteristics of alternating current
- 3 Use AC measuring instruments
- 4 Analyze the nature of inductance
- 5 Examine the effects of a capacitor on AC circuits
- 6 Analyze resistive-inductive series circuits
- 7 Analyze resistance-capacitive series circuits
- 8 Analyze parallel reactive circuits
- 9 Perform complex circuit analysis
- 10 Determine the proper three-phase system for a given application

Wisconsin Technical College System

50-413-752 Codes for Industrial Electricians 1: Introduction to the NEC

Course Outcome Summary

Course Information

Description This course introduces the apprentice to the layout and purpose of the National Electric Code. It also strives to teach the apprentice proper methodology to research a code question and correctly interpret what they are reading. Various examples in the textbook and activity sheets help guide the apprentice through this process. Apprentices will research the structure of the National Electric Code and define the requirements of the code that are common to all electrical installations. In addition, apprentices will examine the installation requirements for fire pumps, emergency systems and fire alarms. This is the first course module of 8 dealing with electrical codes applicable to the trade.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Research the structure of the National Electric Code
- 2 Define requirements of the code that are common to all electrical installations
- 3 Plan the installation of an overcurrent protection device
- 4 Apply article 250 (grounding) to industrial electrical situations
- 5 Apply article 300 (wiring methods) to industrial electrical situations
- 6 Select the proper conductor and raceway for an industrial electrical installations
- 7 Select the proper box, cabinet, gutter and conduit for an industrial electrical installations
- 8 Size cords and cables for typical industrial electrical installations
- 9 Select the required electrical components for typical industrial electrical motor installation
- 10 Plan the protection requirements for a typical industrial electrical transformer installation
- 11 Plan equipment installation in hazardous locations
- 12 Outline servicing and or installation requirements for cranes, hoists, and elevators
- 13 Plan an electric welder installation
- 14 Outline the installation requirements for information and communication cable
- 15 Outline the installation requirements for fire pumps, emergency systems, and fire alarm systems



Wisconsin Technical College System

50-413-753 Codes for Industrial Electricians 2: OCPD and Electrical Device Installations

Course Outcome Summary

Course Information

Description In this module of Codes for Industrial Electricians, apprentices will learn how to plan for the installation of overcurrent protection devices and how to select the proper boxes, cabinets and conduits for industrial electrical installations as called for in the NEC and other electrical codes. This is the second of 8 course modules on the NEC.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Wisconsin Technical College System

50-413-754 Codes for Industrial Electricians 3: Article 250 Part A

Course Outcome Summary

Course Information

Description Course three of 8 examines the application of grounding to industrial electrical situations as required by the NEC and other electrical codes.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-755 Codes for Industrial Electricians 4: Article 250 Part B

Course Outcome Summary

Course Information

Description Course four of 8 on the NEC continues to examine Article 250 and grounding applications for industrial electrical installations. Apprentices will complete their review of this portion of the NEC and examine additional related electrical codes in effect across Wisconsin.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-756 Codes for Industrial Electricians 5: Article 300, Cords/Cables, and Hazardous Installations

Course Outcome Summary

Course Information

Description Course five of 8 examines article 300 of the NEC and wiring methods for industrial electrical applications. In addition, apprentices will determine sizing requirements for cords and cables for installations common to industrial facilities. Finally, the course will identify code requirements for equipment installations in hazardous locations.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-757 Codes for Industrial Electricians 6: Conductors, Raceways and Data/Communication Cables

Course Outcome Summary

Course Information

Description Course six of 8 covers the selection of proper conductors and raceways for industrial electrical installations as required by the NEC and other electrical codes. In addition, course competencies will include examining the installation requirements for data and communication cables.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-758 Codes for Industrial Electricians 7: Motors and Generators

Course Outcome Summary

Course Information

Description Course seven of 8 reviews the code requirements for the selection of electrical components for typical industrial electrical motor installations. Course module includes sizing of controls, conductors, switches, branches, and more.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-759 Codes for Industrial Electricians 8: Transformers

Course Outcome Summary

Course Information

Description Course eight of 8 reviews the electrical code requirements which provide for the protection of various industrial transformer installations. Course competencies include developing plans, sizing equipment and components, safety, and references to applicable sections of the NEC.

Total Credits 0.50

Program Outcomes

- 1 Apply the National Electric Code requirements to industrial equipment and facilities.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-760 Industrial Electrician Transformers

Course Outcome Summary

Course Information

Description This course is designed to introduce the Industrial Electrician Apprentice to the basic concepts of single and three-phase transformers. The course will cover transformer theory, turns, current and voltage ratios as well as proper connections and use of various transformers.

Total Credits 1.00

Program Outcomes

- 1 Apply operational and troubleshooting principles to a transformer installation.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Define the principles of transformer theory
- 2 Analyze the operation of single-phase transformers
- 3 Analyze the operation of three-phase transformers
- 4 Create a remedy table for some of the most common single and three phase transformer problems

Wisconsin Technical College System

50-413-761 Industrial Electrician Motors & Generators

Course Outcome Summary

Course Information

Description This is the first course of 3 courses for industrial electrician apprentices to explore motor controls. This course introduces concepts, terminology, and safety. In addition, this is designed to give the Industrial Electrician Apprentice the knowledge required by industry to maintain electric motors and generators. This course material will cover DC motors and generators, single-phase and three-phase motors, as well as alternators.

Total Credits 1.00

Program Outcomes

- 1 Maintain electric motors and motor controls.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Define the principles of DC generators
- 2 Define the principles of DC motors
- 3 Analyze the operation of alternators
- 4 Analyze the operation of three-phase motors
- 5 Analyze the operation of single-phase motors

Wisconsin Technical College System

50-413-762 Industrial Electrician Motor Controls 1

Course Outcome Summary

Course Information

Description This course will lead you through the fundamentals of electric motor control. You will learn to recognize and draw the basic symbols, the language of motor control, and how to apply these symbols, into current industrial format. You will also learn to draw and read ladder and wiring diagrams. You will be introduced to the logic used in motor control and be required to apply this logic in order to correctly interpret, design, and wire control circuits.

Total Credits 1.00

Program Outcomes

- 1 Maintain electric motors and motor controls.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Apply safety procedures, tools, and instrument to specific situations
- 2 Draw a computer generated ladder diagram
- 3 Complete the decision/action portion of a line drawing
- 4 Draw a circuit that incorporates control devices and timers
- 5 Draw a reversing control circuit for a three-phase DC motor
- 6 Apply electromechanical and solid state devices to a specific situation
- 7 Draw a speed control and a reduced voltage control circuit
- 8 Formulate a preventative maintenance program

Wisconsin Technical College System

50-413-763 Industrial Electrician Motor Controls 2

Course Outcome Summary

Course Information

Description This is the second course of 3 and examines motor controls applicable to the industrial electrician trade.

Total Credits 1.00

Program Outcomes

- 1 Maintain electric motors and motor controls.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.



Wisconsin Technical College System

50-413-764 Industrial Electrician Motor Controls 3

Course Outcome Summary

Course Information

Description This is the third of three courses examining motor controls applicable to the industrial electrician trade. Applications and assessment activities are intended in this course.

Total Credits 1.00

Program Outcomes

- 1 Maintain electric motors and motor controls.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Wisconsin Technical College System

50-413-765 Power Systems & Variable Speed Drives for Industrial Electricians

Course Outcome Summary

Course Information

Description This course provides the opportunity for students to learn about power systems and variable speed drives (VSD's). Topics include electricity, electronics, power transmissions, motor operations, AC and DC motor drives, servo and stepper drives, peripherals and communication. Apprentices will also explore closed loop control, feedback devices, and drive maintenance and the troubleshooting of VSD's. Course includes lab/shop and classroom lecture-lab hours.

Total Credits 2.00

Program Outcomes

- 1 Apply operational and troubleshooting principles to power systems and variable speed drives.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Compare AC and DC drive installations
- 2 Compare traditional and current methods of motor control
- 3 Present the fundamentals of various industrial drive systems
- 4 Analyze the operational characteristics of single-phase, three-phase, AC, DC, servo, and stepper motors
- 5 Create a construction/operation/troubleshooting matrix for various DC drives
- 6 Create a construction/operation/troubleshooting matrix for various AC drives
- 7 Explain the construction, operation, and performance of a servo drive system and a stepper motor installation
- 8 Detail the type of drive peripheral equipment, control system and communication device, and physical installation requirements for a specific situation
- 9 Describe the construction and operation of sensors, controls, and other components used in a closed loop feedback system
- 10 Apply troubleshooting principles to power systems and VSD's

Wisconsin Technical College System

50-413-766 Fluid Power Systems for Industrial Electricians - Pneumatics

Course Outcome Summary

Course Information

Description This is a pneumatics course customized for industrial electrician apprentices who deal with fluid power systems. This course will relate the basics of pneumatic theory and pneumatic components. Safety and the interrelationship between pneumatic power with electrical control is emphasized.

Total Credits 0.50

Program Outcomes

- 1 Apply operational and troubleshooting principles to fluid power systems.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Define the principles of pneumatics
- 2 Interpret pneumatic schematic diagrams
- 3 Analyze the function of pneumatic system components
- 4 Explain the functions of common pneumatic valves
- 5 Apply troubleshooting principles to pneumatic systems

Wisconsin Technical College System

50-413-767 Fluid Power Systems for Industrial Electricians- Hydraulics

Course Outcome Summary

Course Information

Description The hydraulics course is customized for Industrial Electricians and relates the basics of hydraulic theory and hydraulic components. Safety and the interrelationship between hydraulic power with electrical control is emphasized.

Total Credits 0.50

Program Outcomes

- 1 Apply operational and troubleshooting principles to fluid power systems.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Define the principles of hydraulics
- 2 Interpret hydraulic schematic diagrams
- 3 Analyze the function of hydraulic system components
- 4 Explain the functions of the following valves: direction control, check, pressure relief, pressure reducing and flow control
- 5 Apply troubleshooting principles to hydraulic systems

Wisconsin Technical College System

50-413-768 Industrial Electrician Solid State Electronics

Course Outcome Summary

Course Information

Description This course provides the apprentice with the skills and knowledge for troubleshooting basic solid-state devices and circuits. The construction, identification, and operating characteristics of solid-state devices is investigated. The apprentice builds test circuits, gathers and analyzes data, and follows safety procedures. Methods for locating defective components are applied. The replacement of printed circuit board components is performed. Also examined is the effect of temperature on the operation of solid-state devices.

Total Credits 2.00

Program Outcomes

- 1 Test solid state electronic system components.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Examine diodes
- 2 Analyze DC power supplies
- 3 Test transistors
- 4 Troubleshoot transistor applications
- 5 Test specialized transistors
- 6 Test thyristor unilateral devices
- 7 Test thyristor bilateral and triggering devices
- 8 Test transducers and opto-electric devices
- 9 Test basic integrated circuits
- 10 Perform circuit repair, replacement, and protection

Wisconsin Technical College System

50-413-769 Industrial Electrician Programmable Logic Controllers 1

Course Outcome Summary

Course Information

Description This course is designed to teach the fundamentals of programmable logic controller and its programming software. The first course of 3 will introduce terminology, concepts, print reading and safety.

Total Credits 1.00

Program Outcomes

- 1 Apply operational and troubleshooting principles to programmable logic controllers and automation equipment.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Perform basic computer operations
- 2 Illustrate the function of each major component of a Programmable Logic Controller
- 3 Differentiate numbering systems used with Programmable Logic Controllers
- 4 Define the fundamental logic gates used with Programmable Logic Controllers
- 5 Enter basic programming instructions into the SLC-500
- 6 Program timers in the PLC program
- 7 Program counter instructions into the PLC program
- 8 Enter program control instructions into the PLC program
- 9 Enter sequencer and shift register functions into the PLC program
- 10 Summarize the important installation procedures for a PLC in a typical industrial environment
- 11 Apply troubleshooting principles to Programmable Logic Controller programs



Wisconsin Technical College System

50-413-770 Industrial Electrician Programmable Logic Controllers 2

Course Outcome Summary

Course Information

Description This is the second of 3 courses for industrial electrician apprentices.
Total Credits 1.00

Program Outcomes

- 1 Apply operational and troubleshooting principles to programmable logic controllers and automation equipment.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Wisconsin Technical College System

50-413-771 Industrial Electrician Programmable Logic Controllers 3

Course Outcome Summary

Course Information

Description This is the third course of 3 for industrial electrician apprentices. PLC applications and assessment projects are planned.

Total Credits 1.00

Program Outcomes

- 1 Apply operational and troubleshooting principles to programmable logic controllers and automation equipment.
- 2 Interpret industrial equipment drawings and electrical prints.
- 3 Communicate trade and occupational related information effectively.

Wisconsin Technical College System

50-413-772 Green Awareness for the E&I Trades

Course Outcome Summary

Course Information

Description Green Awareness for the E&I Trades examines new and emerging technologies influenced by green trends which are impacting work processes today and in the future. The course introduces apprentices to green related knowledge and skills. Green topics covered in this course include energy efficiency; energy conservation; changes in state, national and local codes; lighting alternatives; alternative energy generation; energy efficient motors, drives, controllers and equipment; eliminating toxic materials and reducing wastes; and specific 'green' applications for the various trades involved under the E&I trades.

Total Credits 1.00

Program Outcomes

- 1 Apply AC and DC theory to an industrial setting.
- 2 Apply the National Electric Code requirements to industrial equipment and facilities.
- 3 Maintain electric motors and motor controls.
- 4 Apply operational and troubleshooting principles to power systems and variable speed drives.
- 5 Apply operational and troubleshooting principles to programmable logic controllers and automation equipment.
- 6 Interpret industrial equipment drawings and electrical prints.
- 7 Communicate trade and occupational related information effectively.

Course Competencies

- 1 Examine industrial lighting alternatives being implemented in industrial plants and facilities (4 hours)
- 2 Summarize alternative methods of power generation (4 hours)
- 3 Compare installation practices impacted by changes in state and national codes (4 hours)
- 4 Be aware of options for reducing toxic materials and minimizing wastes (2 hours)
- 5 Analyze overall energy consumption for a plant or industrial facility (2 hours)
- 6 Summarize how alternative energy efficient motors, drives, and controllers can result in energy savings and conservation (8 hours)
- 7 Relate green applications and more energy efficient operations to other trade specific practices including maintenance, electronics and instrumentation (4 hours)

Wisconsin Technical College System

50-413-773 Safety & Print Reading for Industrial Electricians

Course Outcome Summary

Course Information

Description This course will acquaint the apprentice with the interpretation of "Prints" (blueprints) and other engineering and manufacturing documentation. The primary focus of the course will be on the basics of prints and how they are used to convey information to technicians. Application of electrical prints from industrial settings will be studied.

This course alone cannot produce the qualified industrial journey level worker. It is but a component of a complete apprenticeship which, when complemented with competent and effective on-the-job training by a qualified journey person can produce a technician capable of dealing with the most industrial work situations.

Total Credits 0.50

Course Competencies

- 1 Interpret basic print information
- 2 Deduce information from non-drawing parts of the print
- 3 Interpret metric print information
- 4 Interpret section views
- 5 Interpret welding symbology
- 6 Deduce information from an assembly drawing
- 7 Analyze electrical system prints



Wisconsin Technical College System

47-455-455 Transition to Trainer: Your Role as a Journey Worker

Course Outcome Summary

Course Information

Description Apprenticeship training is a collaborative partnership: employer and employee associations, government, and educational institutions each play a part. In reality, most learning takes place through the daily interaction between an apprentice and his/her co-workers. Surveys have shown that the apprentices are least satisfied with the on-the-job portion of their training--particularly the ability of journey level workers and supervisors to pass on their knowledge of the trade.

You have already learned to use the tools of your chosen trade. In this workshop you will be introduced to a new set of basic tools--the tools of a jobsite trainer. You will explore the skills that are necessary to be an effective trainer, discover how to deliver hands-on training, and examine the process for giving useful feedback. During the workshop you will build a Training Toolkit to take back to your work on the job.

Course Competencies

- 1 Value your role as a journey worker trainer
- 2 Serve as a mentor and job coach
- 3 Foster a positive work environment by acting as an ally/advocate
- 4 Provide hands-on skills training
- 5 Provide feedback on apprentice performance