

**Wisconsin Technical College System
Curriculum Standards Model & Program Design Summary
50-414-2 ELECTRICAL & INSTRUMENTATION APPRENTICE**

Program Information

Program Description

Electrical & Instrumentation Technicians install, service, troubleshoot; and perform preventive and predictive maintenance functions on equipment. This includes plant lighting equipment and receptacle circuits, motors, starters, motor control centers, programmable controllers, control panels, electrical control systems and transformers. They may also service high voltage electrical systems, and ensure that work is in accordance with relevant codes. They repair, test, adjust, calibrate or install electronic equipment, such as industrial controls, transmitters, and antennas.

External Requirements

- 5 to 6 year training program
- 9,392 hours on-the-job training
- 1,008 hours paid related instruction
- Additional related instruction may be required
- Classroom training includes study of electrical codes, electronics, electrical systems, safety, controllers, instrument mechanics and process measurements

Entry Requirements

- Applicants must be at least 18 years of age
- Entry requirements vary by employer
- High school diploma or equivalent
- Physically able to perform trade
- Applicants apply directly to participating employers

Program Outcomes (Pending 2013-2014 project)

Program Configurations

50-414-2 WTCS E&I Apprenticeship Related Instruction Program

The program configuration for the E&I Apprenticeship Related Instruction follows the courses and sequence used by the Industrial Electrician Apprenticeship for the first 9 semesters, and then adds additional coursework in electronics, instrumentation, motor control and process control. This model assumes an accelerated first year to mirror the Industrial Electrician program; an accelerated model used here assumes 4 credits in the first two semesters and twice the hours in class.

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 11 for reference.

Total credits = 28.5 and total hours including Transition to Trainer = 1,034.

Credits

Total Credits= 28.50

Total Hours= 1,034 (includes 8 hours for 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 & Hours	Course Description
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	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

	Electricians		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.
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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	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

	Controllers 1		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
50-414-721	Intro to Instrumentation and Measurement for E&I	2.00 72 hours	Apprentices will learn to describe and explain the make-up of an automatic control loop, the function of each of the control loop elements and the terms used to describe the loop performance and characteristics and perform mathematical functions associated with offset math and apply the concepts to common signaling systems used in process control systems. Course will examine the principles, methods and devices used to measure flows, temperatures, pressures, levels, and densities in various industrial process applications. Course will explore common methods and types of equipment used to measure chemical components of a material or stream. This course was formerly the MOD-11 unit in related instruction.

Term 11

Course #	Course Title	Credits & Hours	Course Description
50-414-723	Motor Controls for E&I Trades	2.00 72 hours	Course explores the basic operation and applications for solid-state devices in motor control installations, the construction and operation of the various types of electromagnetic and solid-state relays, and the principles of operation and applications for photoelectric and proximity control devices. Apprentices will learn to describe the various mechanical and electronic methods used in accelerating and decelerating AC and DC motors and explain the construction and theory of operation of electronic DC and AC motor drives and controllers. Course covers the construction and operation of the various sensors and telemetry devices employed in electronic control of motors. Apprentices will learn how to gather information, select test equipment, and implement the proper techniques in troubleshooting an electrical motor control circuit. This course was formerly the MOD-13 unit in related instruction.

Term 12

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>
50-414-722	Process Control for E&I	2.00 72 hours	<p>Apprentices will learn to describe and explain the make-up of an automatic control loop, the function of each of the control loop elements and the terms used to describe the loop performance and characteristics and to perform mathematical functions associated with offset math and apply the concepts to common signaling systems used in process control systems. Course examines the various methods of transmitting sensor signals and lists the advantages/disadvantages of each type of system. The principles associated with various types of control valves and accessories used as final control elements within a process are applied to common work processes. Apprentices will learn to explain the purpose of the process controller and the characteristics of a properly tuned process control loop; and the basic theory of Distributed Control Systems and describe the physical make-up and design considerations of the DCS systems. This course was formerly the MOD-12 unit for related instruction.</p>

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

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

50-414-711 Personal Computers for E&I

Course Outcome Summary

Course Information

Description Course competencies include explaining the function of each of the computer's hardware components and the function of the software, demonstrating the ability to perform basic computer functions in the DOS and Windows environment, describe the tasks and procedures that can be accomplished with the Windows program and demonstrate the ability to use Windows, and describe the common mistakes and problems that can occur when using computer hardware or accessing a program. This course was formerly Module 1 for related instruction.

Course Competencies

- 1 Explain the function of each of the computer's hardware components and the function of the software
- 2 Explain and demonstrate the ability to perform basic computer functions in the DOS and Windows 3.11 environment
- 3 Describe the tasks and procedures that can be accomplished with the Windows 95 program and demonstrate the ability to use Windows
- 4 Describe the common mistakes and problems that can occur when using computer hardware or accessing a program

Wisconsin Technical College System

50-414-712 DC Circuits for E&I

Course Outcome Summary

Course Information

Description Course examines the necessary mathematical functions needed to execute electrical and electronic calculations and apply basic atomic theory to voltage, current and resistance in DC circuits. Apprentices will learn the characteristics and calculate the voltage, current, resistance and power dissipated for a parallel D.C. circuit, and use Ohm's law to explain the relationship between voltage, current and resistance in a simple circuit. Apprentices will use series and parallel calculation methods and rules to analyze complex combination circuits commonly experienced by the trade. Students will learn to identify the various types of resistors; determine their values and tolerance by color code, and detail the characteristics of various conductors. This course was formerly Module 2 in related instruction.

Course Competencies

- 1 Perform the necessary mathematical functions needed to execute electrical and electronic calculations
- 2 Describe basic atomic theory and its relationship with voltage, current and resistance
- 3 Identify the various types of resistors; determine their values and tolerance by color code and detail the characteristics of various conductors
- 4 Use Ohm's law to explain the relationship between voltage, current and resistance in a simple circuit
- 5 Explain the characteristics and calculate the voltage, current, resistance and power dissipated for a parallel D.C. circuit
- 6 State the characteristics and calculate the voltage, current, resistance and power dissipated for a parallel D.C. circuit
- 7 Use series and parallel calculation methods and rules to analyze complex combination circuits
- 8 Use Kirchoff's laws and Delta - Wye conversion methods to analyze circuits of greater complexity
- 9 Describe the characteristics, construction and operation of the various primary and secondary cells

Wisconsin Technical College System

50-414-713 Magnetism and Electromagnetism for E&I Trades

Course Outcome Summary

Course Information

Description This course was formerly MOD-3 in related instruction.

Course Competencies

- 1 Explain the terms and fundamental concepts of magnetism and electromagnetism
- 2 Describe the construction, operation and applications of the various DC measuring instruments

Wisconsin Technical College System

50-414-714 AC Circuits for E&I Trades

Course Outcome Summary

Course Information

Description This course was formerly Mod-4 in related instruction.

Course Competencies

- 1 Solve for unknown lengths and angles of right triangles using trigonometric functions and the Pythagorean Theorem
- 2 Describe, calculate and measure the various time and amplitude related values associated with alternating waveforms
- 3 Use an oscilloscope to measure voltage, current, frequency, and phase relationships of various DC and AC waveforms
- 4 Describe inductance, the physical factors, which determine the amount of inductance, inductive reactance
- 5 Analyze series and parallel RL circuits by calculating the voltages, currents, impedances and power
- 6 Describe capacitance, the physical factors that determine the amount of capacitance and the effect of capacitance in an AC circuit
- 7 Analyze series and parallel RC circuits by calculating the voltages, currents, impedance and power
- 8 Analyze series RC, RL and RCL circuits by calculating voltages, current, impedance and power

Wisconsin Technical College System

50-414-715 Power Distribution for E&I Trades

Course Outcome Summary

Course Information

Description Course examines the principles surrounding the efficiency, power factor and the true, reactive and apparent power of a single phase AC circuit. Apprentices will learn to describe the construction and operation of the various types of DC generators and AC alternators and analyze wye and delta connected three-phase power systems by determining voltage, current and power relationships. The course explores how to determine the power factor and the values of the components needed to correct the power factor to a specific percentage and describe the various types of fuses and circuit breakers used for modern circuit protection. This course was formerly MOD 5 in related instruction.

Course Competencies

- 1 Determine the efficiency, power factor and the true, reactive and apparent power of a single phase AC circuit
- 2 Describe the construction and operation of the various types of DC generators and AC alternators
- 3 Analyze wye and delta connected three-phase power systems by determining voltage, current and power relationships
- 4 Determine the power factor and the values of the components needed to correct the power factor to a specific percentage
- 5 Describe the various types of fuses and circuit breakers used for modern circuit protection

Wisconsin Technical College System

50-414-716 National Electric Code for E&I Trades

Course Outcome Summary

Course Information

Description Course covers the general layout, purpose and intent of the National Electrical Code as well as enforcement responsibility and the methods used to define special terms. It explores the methods, permitted/prohibited uses and installation requirement for the various raceways employed in electrical installations as well as the installation requirements and methods for cable assemblies and conductors. Apprentices will examine the requirements for installing conductors and cables in raceways, cabinets, boxes and direct burial applications according to NEC and other electrical codes. Installation requirements required by NEC for electrical services conductors and equipment, overcurrent devices, grounding and bonding electrical systems and equipment, and motor and motor controller installations, transformer installations and NEC classifications and installation requirements for hazardous locations will be reviewed. The NEC requirements for lighting fixtures, lamps and lamp holders and receptacles will also be reviewed. This course was formerly the MOD-6 unit in related instruction.

Course Competencies

- 1 Describe the general layout, purpose and intent of the National Electrical Code as well as enforcement responsibility and the methods used to define special terms
- 2 Describe the methods, permitted/prohibited uses and installation requirement for the various raceways employed in electrical installations
- 3 Describe the installation requirements and methods for cable assemblies and conductors
- 4 Detail the requirements for installing conductors and cables in raceways, cabinets, boxes and direct burial applications
- 5 Describe the installation requirements for electrical services conductors and equipment
- 6 Describe the installation requirements for overcurrent devices in electrical installations
- 7 Detail the installation requirements for grounding and bonding electrical systems and equipment
- 8 Detail the NEC requirements for motor and motor controller installations
- 9 Detail the NEC requirements for transformer installations
- 10 Detail the NEC requirements for lighting fixtures, lamps and lamp holders and receptacles
- 11 Detail the NEC classifications and installation requirements for hazardous locations

Wisconsin Technical College System
50-414-717 Transformers for E&I Trades
Course Outcome Summary

Course Information

Description This course was formerly the MOD-7 unit in related instruction.

Course Competencies

- 1 Describe the basic operation, associated losses and electrical relationships for a simple transformer.
- 2 Describe the single and three-phase, transformer connections and calculate their power, voltage and current ratings
- 3 Explain the operation and applications of instrumentation and special purpose transformers
- 4 Describe the installation and testing requirements for various transformer installations

Wisconsin Technical College System

50-414-718 Motors for the E&I Trades

Course Outcome Summary

Course Information

Description Course examines the basic operation, the various parts, and the power produced by a typical DC generator. Apprentices will learn to describe the construction; characteristics and principles of operation of the various types of DC motors used for industrial applications and associated work processes. The course reviews the concepts and principles associated with the construction, characteristics and principles of operation of the various types of single-phase AC motors and polyphase motors. Course explores the common maintenance and troubleshooting procedures needed to maintain an electrical installation containing AC and DC motors. NEC requirements for motor and motor controller installations will be applied. This course was formerly the MOD-8 unit in related instruction.

Course Competencies

- 1 Describe the basic operation, the various parts and the power produced by a typical DC generator
- 2 Describe the construction, characteristics and principles of operation of the various types of DC motors used for industrial applications
- 3 Describe the construction, characteristics and principles of operation of the various types of single-phase AC motors
- 4 List the different types of polyphase motors and describe their construction and operating characteristics
- 5 Explain the common maintenance and troubleshooting procedures needed to maintain an electrical installation containing AC and DC motors
- 6 Detail the NEC requirements for motor and motor controller installations

Wisconsin Technical College System

50-414-719 Motor Control I for E&I Trades

Course Outcome Summary

Course Information

Description Apprentices will learn to identify the basic control device symbols associated with electrical wiring, layout and ladder logic diagrams and describe the operation and the various applications for relays contactors and motor starters. Concepts related to the types and operation of the various timers, counters and sequencers used in motor control circuits used to provide special effects will be explored. The operation and electrical characteristics of the various types of pilot devices will be reviewed. Motor control circuit that meets the operational requirements of a specific process or equipment will be analyzed and designed. The proper methods used to maintain electrical equipment along with service procedures used to troubleshoot failed equipment and circuits will be examined. This course was formerly the MOD-9 unit in related instruction.

Course Competencies

- 1 Identify the basic control device symbols associated with electrical wiring, layout and ladder logic diagrams
- 2 Describe the operation and the various application for relays contactors and motor starters
- 3 Describe the types and operation of the various timers, counters and sequencers used in motor control circuits to provide special effects
- 4 Describe their operation and electrical characteristics of the various types of pilot devices
- 5 Design and use a motor control circuit that meets the operational requirements of a specific process or equipment
- 6 Describe the proper methods used to maintain electrical equipment and procedures used to troubleshoot failed equipment and circuits

Wisconsin Technical College System

50-414-720 Electronics for the E&I Trades

Course Outcome Summary

Course Information

Description Course explores the construction and operation of the pn junction and the operation of various types of diodes and their applications. Concepts related to the operation and characteristics of the various types of rectifier and filter circuits is included along with the characteristics and operation of the bipolar junction transistors and the basic operation of the amplifiers. Apprentices will learn to identify and explain the various operational configurations associated with bipolar junction transistors and describe the operating characteristics, basic applications and testing and troubleshooting techniques for field effect transistors. Course includes the basic operating characteristics of the various operational amplifier (op-amp) configurations and the operating characteristics and application of the various types of thyristors. Principles associated with the operations and applications of photoelectric, Laser and fiberoptic devices will be covered. This course was formerly the MOD-10 unit in related instruction.

Course Competencies

- 1 Describe the construction and operation of the pn junction
- 2 Detail the operation of various types of diodes and their applications
- 3 Describe the operation and characteristics of the various types of rectifier and filter circuits
- 4 Detail the characteristics and operation of the bipolar junction transistors and the basic operation of the amplifier
- 5 Identify and explain the various operational configurations associated with bipolar junction transistors
- 6 Describe the operating characteristics, basic applications and testing and troubleshooting techniques for field effect transistors
- 7 Detail the basic operating characteristics of the various operational amplifier (op-amp) configurations
- 8 Detail the operating characteristics and application of the various types of thyristors
- 9 Detail the operations and applications of photoelectric, Laser and fiberoptic devices

Wisconsin Technical College System

50-414-721 Intro to Instrumentation and Measurement for E&I

Course Outcome Summary

Course Information

Description Apprentices will learn to describe and explain the make-up of an automatic control loop, the function of each of the control loop elements and the terms used to describe the loop performance and characteristics and perform mathematical functions associated with offset math and apply the concepts to common signaling systems used in process control systems. Course will examine the principles, methods and devices used to measure flows, temperatures, pressures, levels, and densities in various industrial process applications. Course will explore common methods and types of equipment used to measure chemical components of a material or stream. This course was formerly the MOD-11 unit in related instruction.

Course Competencies

- 1 Describe and explain the make-up of an automatic control loop, the function of each of the control loop elements and the terms used to describe the loop performance and characteristics
- 2 Perform mathematical functions associated with offset math and apply the concepts to common signaling systems used in process control systems
- 3 Explain the principles, methods and devices used to measure pressure in an industrial process application
- 4 Explain the principles, methods and devices used for level and density measurements in industrial process applications
- 5 Explain the principles, methods and devices used to measure temperature in an industrial process application
- 6 Describe the principles, methods and devices used for flow measurement in industrial process applications
- 7 Detail the methods and types of equipment used to measure chemical components of a material or stream

Wisconsin Technical College System

50-414-722 Process Control for E&I

Course Outcome Summary

Course Information

Description This course was formerly the MOD-12 unit for related instruction.

Course Competencies

- 1 Describe and explain the make-up of an automatic control loop, the function of each of the control loop elements and the terms used to describe the loop performance and characteristics
- 2 Perform mathematical functions associated with offset math and apply the concepts to common signaling systems use used in process control systems
- 3 Detail the various methods of transmitting sensor signals and list the advantages/disadvantages of each type of system
- 4 Describe the various types of control valves and accessories used as final control elements within a process
- 5 Explain the purpose of the process controller and the characteristics of a properly tuned process control loop
- 6 Explain the basic theory of Distributed Control Systems and describe the physical make-up and design considerations of the DCS system

Wisconsin Technical College System

50-414-723 Motor Control II for E&I

Course Outcome Summary

Course Information

Description Course explores the basic operation and applications for solid-state devices in motor control installations, the construction and operation of the various types of electromagnetic and solid-state relays, and the principles of operation and applications for photoelectric and proximity control devices. Apprentices will learn to describe the various mechanical and electronic methods used in accelerating and decelerating AC and DC motors and explain the construction and theory of operation of electronic DC and AC motors drives and controllers. Course covers the construction and operation of the various sensors and telemetry devices employed in electronic control of motors. Apprentices will learn how to gather information, select test equipment, and implement the proper techniques in troubleshooting an electrical motor control circuit. This course was formerly the MOD-13 unit in related instruction.

Course Competencies

- 1 Detail the basic operation and applications for solid-state devices in motor control installations
- 2 Describe the construction and operation of the various types of electromagnetic and solid-state relays
- 3 Explain the principle of operation and applications for photoelectric and proximity control devices
- 4 Detail the various mechanical and electronic methods used in accelerating and decelerating AC and DC motors
- 5 Explain the construction and theory of operation of electronic DC and AC motors drives and controllers
- 6 Describe the construction and operation of the various sensors and telemetry devices employed in electronic control of motors
- 7 Demonstrate the ability to gather information, select test equipment and implement the proper techniques in troubleshooting an electrical motor control circuit

Wisconsin Technical College System

50-414-724 Programmable Controllers for E&I

Course Outcome Summary

Course Information

Description This course was formerly the MOD-14 unit in related instruction.

Course Competencies

- 1 Identify the main parts of a Programmable Logic Controller (PLC) by briefly describing their purpose and operation within the overall system
- 2 Describe the various types of number systems, such as binary, octal, hexadecimal and BCD, and convert values from one system to another
- 3 Detail the various logic functions used to implement instructions within a Programmable Logic Controller
- 4 Explain the memory organization and addressing fundamentals used in programming a PLC
- 5 Convert basic relay logic diagrams into PLC logic ladder diagrams
- 6 Explain the various timing functions available with a PLC and demonstrate the ability to program the instructions
- 7 Explain the various program counter functions available with PLC and demonstrate the ability to program the instructions
- 8 Explain the various program control instructions and enter these into a PLC program
- 9 Define data manipulation, analog and math instructions and explain their application in the programming of a PLC
- 10 Describe the various types of sequencer instructions and their application in programming a PLC
- 11 Explain the various types of analog input and output signals and the PLC instructions and equipment used to process these signals
- 12 Describe the installation, start-up and troubleshooting procedures used for a PLC system

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