

ELECTRICAL (ELY)

ELY 112 Electrical Foundations I & Lab

5 Class Hours, 2 Lab Hours, 6 Quarter Credit Hours

This basic course in electricity introduces the student to atomic theory; the fundamental units of volts, amps, ohms and watts; Ohm's Law and the power equations; scientific notation and metric prefixes; circuit analysis of series, parallel and series-parallel circuits; Kirchhoff's laws for series and parallel circuits; and troubleshooting. Special emphasis is placed on formula transposition and algebraic notations for voltage and current. Students participate in laboratory analysis of DC series, parallel and series-parallel circuits using analog VOMS and digital multimeters with a DC power source. They are taught proto board techniques and use the resistor color code extensively. Shorts, opens and various troubleshooting techniques are included. Students will also be familiarized with occupational trends and careers in the electrical industry.

ELY 116 Introduction to Residential Wiring/NEC I

3 Class Hours, 3 Quarter Credit Hours

Students practice navigating through the National Electrical Code standards as they learn code and trade terminology and the minimum code requirements for such topics as switching, conductor sizing, overcurrent protection, box fill, voltage drop, grounding and bonding, and wiring methods. Individual state amendments to the Code are also studied. Students diagram basic electrical branch circuits in variety of configurations.

ELY 117 Basic Wiring Techniques Lab

2 Lab Hours, 1 Quarter Credit Hours

This course supports ELY 116 by introducing students to the tools of the trade. Students practice wiring techniques which will include mounting and wiring boxes and installing receptacles, lights and switches using non-metallic sheathed cable and metallic-sheathed cable. Safe work practices are emphasized as part of preparation to enter the workforce.

ELY 118 NEC and Residential Wiring Lab I

3 Class Hours, 2 Lab Hours, 4 Quarter Credit Hours

Students practice navigating through the National Electrical Code (NEC) standards as they learn code and trade terminology and the minimum code requirements for such topics as switching, conductor sizing, overcurrent protection, box fill, voltage drop, grounding and bonding, and wiring methods. Individual state amendments to the Code are also studied. Students diagram basic electrical branch circuits in variety of configurations. The students practice wiring techniques which will include mounting and wiring boxes and installing receptacles, lights and switches using non-metallic sheathed cable and metallic-sheathed cable. Safe work practices are emphasized as part of preparation to enter the workforce.

ELY 122 Electrical Foundations II & Lab

6 Class Hours, 2 Lab Hours, 7 Quarter Credit Hours

Prerequisites: ELY 112 and (MA 110 or MA 105)

Three key topics are covered in this course: 1) Inductance and Capacitance: topics include magnetism, coils, electromagnetic induction, capacitors, RL and RC time constants and transient voltages and currents. 2) Alternating Current Circuits: topics include sine wave analysis, RL and RC series and parallel circuit analysis, power factor and power factor correction methods. 3) Power and Generation: topics include DC and AC generation including basic armature winding theory, power and efficiency calculations showing the relationships among heat, light and power units. Throughout the course, students will construct, connect, and troubleshoot AC resistive, inductive, and capacitive circuits and analyze the circuits using measuring instruments that include the oscilloscope and frequency generator.

ELY 126 Residential Wiring/NEC II

1 Class Hours, 1 Quarter Credit Hours

Prerequisites: ELY 116 and ELY 117 and (MA 100 or MA 105 or MA 110)

Students continue in their studies of the National Electrical Code standards. Minimum requirements for general lighting, small appliance, laundry, and bathroom branch circuits are explored. Other topics includes the required receptacle and lighting locations, attic and basement cable installation, circuit protection (fuses and circuit breakers), personnel protection (GFCI and AFCI) and device protection (TVSS). Students explore the science of light basics as well as the different types of lamps (incandescents, CFLs and LEDs) to better comprehend the importance of energy management and energy efficiency.

ELY 127 Residential Wiring Lab II

4 Lab Hours, 2 Quarter Credit Hours

Prerequisites: ELY 116 and ELY 117 and (MA 100 or MA 105 or MA 110)

Students wire a variety of scenarios to authentically experience working in residential situations. From given specifications, they create a set of blueprints and calculate box fill. They then rough in and trim each lab. With guidance and under supervision, they energize and test each lab wearing the appropriate PPE. Students are required to work in a neat and workmanlike manner which includes housekeeping practices. Lastly, students create invoices that detail the material used with prices and labor costs.

ELY 128 NEC and Residential Wiring Lab II

1 Class Hours, 4 Lab Hours, 3 Quarter Credit Hours

Prerequisites: ELY 118 and (MA 110 or MA 105)

Students continue in their studies of the National Electrical Code (NEC) standards. Minimum requirements for general lighting, small appliance, laundry, and bathroom branch circuits are explored. Other topics include the required receptacle and lighting locations, attic and basement cable installation, circuit protection (fuses and circuit breakers), personnel protection (GFCI and AFCI) and device protection (TVSS). Students also explore the science of lighting types to better comprehend the importance of energy management and energy efficiency. Students wire a variety of scenarios of working in residential situations. From given specifications, they create a set of blueprints and calculate box fill and then rough in and trim each lab project. With guidance and under supervision, they energize and test each lab wearing the appropriate PPE. Students are required to work in a neat and workmanlike manner which includes housekeeping practices. Lastly, students create invoices that detail the material used with prices and labor costs.

ELY 132 Transformers & Lab

2 Class Hours, 2 Lab Hours, 3 Quarter Credit Hours

Prerequisites: ELY 122 and MA 125

Students study the construction, operation and connections for single phase transformers, three phase transformers, autotransformers, current and potential transformers. Current, voltage and power relationships are examined. Phasing techniques, polarity checking, and closure testing are also investigated. A variety of cooling methods are also explored. Areas of practice include series and parallel connections, single-phase polarity checks, three-phase transformer connections and buck-boost connections. National, Massachusetts and Rhode Island Electrical Code requirements are studied.

ELY 138 Advanced Wiring/NEC III

4 Class Hours, 4 Quarter Credit Hours

Prerequisites: (ELY 126 and ELY 127 or ELY 128)

The topics covered include residential service entrance installation and calculations, conductor resistance, conductor insulation and conduit fill calculations, low voltage structured wiring, fire alarms and voltage drop calculations. All pertinent National, Massachusetts, and Rhode Island Electrical Code articles are covered. Code software will supplement the text material throughout the course

ELY 139 Advanced Wiring III Lab

4 Lab Hours, 2 Quarter Credit Hours

Prerequisites: (ELY 126 and ELY 127 or ELY 128)

Areas of practice include installation and test of residential service entrance and advanced general lighting and individual appliance circuits. Additional topics covered are fire alarms, low voltage structured wiring, conduit installation, wire pulls and basic construction techniques. Other areas of practice include the use of power tools such cutting conduit with bandsaws and sawsalls, threading conduit with manual and power threaders, and drilling concrete with hammerdrills for anchoring purposes.

ELY 140 NEC and Advanced Residential/Commercial Wiring Lab III

4 Class Hours, 4 Lab Hours, 6 Quarter Credit Hours

Prerequisites: ELY 128

The topics covered include residential service entrance installation and calculations, conductor resistance, conductor insulation and conduit fill calculations, low voltage structured wiring and voltage drop calculations. All pertinent National, Rhode Island and Massachusetts Electrical Code articles are covered. Code software will supplement the text material throughout the course. Areas of practice include installation and test of residential service entrance, advanced general lighting, individual appliance circuits and fire/home safety devices. Additional installation topics covered are low voltage structured wiring, conduit installation, wire pulls and basic construction techniques. Other areas of practice include the use of power tools such cutting conduit with bandsaws and reciprocating saws, threading conduit with manual and power threaders, and drilling concrete with hammer-drills for anchoring purposes.

ELY 212 Motor Theory

4 Class Hours, 4 Quarter Credit Hours

Prerequisites: ELY 132 and (MA 125)

Students explore manual and magnetic starters and control circuits. Areas of study include starting and running overcurrent protection, various two-wire and three-wire control schemes, timer applications, reversing controls, multi-speed control, pilot devices and the similarities and differences of NEMA and IEC controls. Emphasis is placed on drawing and reading schematic and wiring diagrams as well as the construction, connection, testing, and troubleshooting of various motor control circuits. Sizing of motor control equipment is performed in accordance with the National Electrical Code.

ELY 213 Motor Controls & Lab

1 Class Hours, 8 Lab Hours, 5 Quarter Credit Hours

Prerequisites: ELY 132 and OSH 010 and (MA 125)

Corequisites: ELY 212, ELY 217

Students explore manual and magnetic starters and control circuits. Areas of study include starting and running overcurrent protection, various two-wire and three-wire control schemes, timer applications, reversing controls, multi-speed control, pilot devices and the similarities and differences of NEMA and IEC controls. Emphasis is placed on drawing and reading schematic and wiring diagrams as well as the construction, connection, testing, and troubleshooting of various motor control circuits. Sizing of motor control equipment is performed in accordance with the National Electrical Code.

ELY 217 AutoCAD Electrical

1 Class Hours, 2 Lab Hours, 2 Quarter Credit Hours

The AutoCAD Electrical course will give students the necessary AutoCAD instruction so they can implement AutoCAD fundamentals into the AutoCAD Electrical software package. Students will be using the latest version of AutoCAD Electrical for the design of control system schematics and connections, control panel layout, PLC systems and electrical distribution systems.

ELY 218 Building Construction & Environmental Systems for Electricians

4 Class Hours, 4 Quarter Credit Hours

This course is an introduction to building construction: structurally non-structurally and to fundamental mechanical and life-safety systems. Topics will include building construction; methods and materials & construction terminology. Environmental systems: power/lighting systems (review), plumbing systems, HVAC systems, fire protection systems & elevators/escalators. Print-reading of building construction & environmental systems and building types will focus on residential and commercial buildings.

ELY 224 Industrial Controls

5 Class Hours, 5 Quarter Credit Hours

Prerequisites: ELY 132 and ELY 212 and ELY 213 and ELY 217

Students will study industrial wiring practices, electro-mechanical and electronic sensors, and the foundations of digital electronics. Applications of these topics will also be discussed. This course begins with an introduction to industrial wiring by reviewing NEC Article 430 concepts and familiarizing students with the NFPA 79 standard. The operation and application of electronic industrial sensors is explored; types include electromechanical devices, inductive and capacitive proximity detectors, ultrasonic sensors, and photoelectric detectors. Analog sensors such as, thermocouples, RTD and pressure sensors will also be discussed. Topics covered on digital electronics include the theory and application of semiconductor diodes, transistors, SCRs, TRIACs and similar devices. Power supplies, half and full wave rectification, filtering and voltage regulation are investigated. The functions, truth tables, and applications of digital logical gates are studied. The course also includes comparing digital to analog devices.

ELY 225 Industrial Controls Lab

4 Lab Hours, 2 Quarter Credit Hours

Prerequisites: ELY 132 and ELY 212 and ELY 213 and ELY 217

Students practice a variety of conduit bending techniques, conduit installations, wire pulls, the drawing and reading of three-phase motor control schematics and wiring diagrams using AutoCAD Electrical. Students also will construct, install, connect, test, and troubleshoot various three-phase motor control configurations. Other areas of study include a review of OSHA requirements for "lock-out-tag-out."

ELY 231 Electronic Motor Drive Systems

5 Class Hours, 5 Quarter Credit Hours

Prerequisites: ELY 222 and ELY 223

Corequisites: ELY 233, ELY 237

ELY 231 Electronic Motor Drive Systems 5 Class Hours 5 Quarter Credit Hours Prerequisites: ELY 222, ELY 223 This course begins with a review of the physics of motion as well as a review of AC and DC motor theory. The following topics will be discussed: reduced voltage starting techniques of AC motors, Variable Frequency Drives (VFDs) including vector technology, constant torque and variable torque applications, braking methods, VFD installations and common bus technology. Students will also investigate and diagnose the effects that VFDs have on power source quality, such as harmonic distortion. DC drive technology topics encompass thyristor control, DC drive controls, regenerative and dynamic braking. The course will also include closed loop control methods and the sensors used in motor control. Proportional, Integral, Derivative (PID) control will be introduced and rotary optical encoders will be used for closed loop motor control.

ELY 233 Adv Industrial Controls Lab

4 Lab Hours, 2 Quarter Credit Hours

Prerequisites: ELY 222 and ELY 223

Corequisites: ELY 231, ELY 237

ELY 233 Advanced Industrial Controls Lab 4 Lab Hours 2 Quarter Credit Hours Prerequisites: ELY222, ELY223 Students continue to work on installation and wiring of single and three-phase motor branch circuits for various motor control configurations. Also included are labs which involve the wiring and/or programming of such devices or systems as: digital circuits, stepper and servo motors, DC drives, AC variable frequency drives, and troubleshooting labs. Other areas of practice include the use of power tools such as cutting conduit with band-saws and reciprocating saws as well as securing boxes and conduit using drills/drivers.

ELY 237 Adv ProgLogic Controllers&Lab

2 Class Hours, 6 Lab Hours, 5 Quarter Credit Hours

Prerequisites: ELY 227

Corequisites: ELY 231, ELY 233

ELY 237 Advanced Programmable Logic Controllers & Lab 2 Class Hour 6 Lab Hours 5 Quarter Credit Hours Prerequisite: ELY 227 Using the Allen-Bradley SLC500, Micrologix 1500 and RSLogix 500 software, the student learns advanced programming techniques. Topics include SLC500 advanced instruction set, analog control, operator interface using Panelview displays, introduction to SCADA systems, and the interfacing PLCs with other automation devices such as Variable Frequency Drives. Industrial networking which incorporates Ethernet IP, ControlNet and DeviceNet will also be introduced. Students create, write and wire programs using the Allen-Bradley SLC500 PLC and the Panelview operator interface to interface the PLC with AC drive systems. Students will practice advanced analog programming, such as temperature control using thermocouples. Additional lab projects will incorporate 24 volt DC wiring of sinking and sourcing inductive sensors to the SLC 500 PLC.

ELY 244 Electronic Motor Drive Systems

6 Class Hours, 6 Quarter Credit Hours

Prerequisites: ELY 224 and ELY 225

Corequisites: ELY 245

This course begins with a review of the physics of motion as well as a review of AC and DC motor theory. The following topics will be discussed: closed loop control systems, reduced voltage starting techniques for AC motors, Variable Frequency Drives (VFDs), and DC drives. Subjects covered in closed loop control will include: tachometers, resolvers, linear and rotary optical encoders, and proportional, integral, derivative (PID) algorithms. Students will explore fundamental drive technology by studying microprocessor controls, constant torque and variable torque applications, braking methods, and installation requirements. DC drive concepts will cover thyristor control, motor speed and torque characteristics, and maintenance. AC drive topics will include the common control algorithms – V/Hz, flux vector, and field oriented control; common bus technology; and the effects that VFDs have on power source quality, such as harmonic distortion.

ELY 245 Advanced Industrial Controls Lab

6 Lab Hours, 3 Quarter Credit Hours

Prerequisites: ELY 224 and ELY 225

Corequisites: ELY 244

Students continue to work on installation and wiring of single and three-phase motor branch circuits for various motor control configurations. Also included are labs which involve the wiring and/or programming of such devices or systems as DC drives, AC variable frequency drives, and troubleshooting labs. Other areas of practice include the use of power tools such as cutting conduit with bandsaws and reciprocating saws.

ELY 249 Legacy PLCs & Troubleshooting

2 Class Hours, 2 Lab Hours, 3 Quarter Credit Hours

Prerequisites: ENG 210

ELY 249 Legacy PLCs & Troubleshooting 2 Class Hours 2 Lab Hours 3 Quarter Credit Hours Prerequisite: ENG 210 Using the Allen-Bradley SLC500 and Micrologix 1500 programmable logic controller (PLC) with RSLogix 500 software, the student learns programming techniques specific to legacy PLCs and operator interfaces. Topics include the SLC500 advanced instruction set, operator interface using PanelView displays, introduction to SCADA systems, and the interfacing PLCs with other automation devices such as Variable Frequency Drives. Industrial networking which incorporates Ethernet IP, ControlNet and DeviceNet will also be introduced. Students create, write and wire programs using the Allen-Bradley SLC500 PLC and the PanelView operator interface to interface the PLC with AC drive systems. Students will also spend time learning to troubleshoot both the hardware and software in PLC-based systems.

ELY 250 Low Voltage Systems and Fiber Optics

2 Class Hours, 2 Lab Hours, 3 Quarter Credit Hours

Prerequisites: ELY 132 and (ELY 138 or ELY 140)

This course will cover the installation and design of low voltage electrical systems. Students will learn the codes, cable types, system components, and installation practices required for voice, data, security, and fire alarm systems. They will analyze each aspect of the installation process to understand the devices and techniques associated with each area and to identify potential problem areas. Lab exercises are designed to provide the students with real-world practice applying and perfecting the specific skills required in this field while also providing structured troubleshooting experience using cable and network test equipment.

ELY 283 Photovoltaic Systems & Lab

4 Class Hours, 4 Lab Hours, 6 Quarter Credit Hours

Corequisites: ELY 290, SCI 110

Prerequisite: Student in Electrical Technology with Renewable Energy (ELRE) must hold their OSHA card in order to enter the seventh term of the program. This course focuses on the design, selection and installation of solar photovoltaic systems. The course will include an in-depth exploration of the mathematical equations to ensure that the photovoltaic system design and installation is appropriate for its intended use and will meet all NEC Article 690 code requirements. Students will be required to prepare a quarter-long research project that will require students to research all components necessary for a "Stand Alone PV System". The labs will include desktop trainers which will simulate the "real world" applications of PV systems and reinforce the principles of photovoltaics. Once students understand basic PV theory, they will then build actual grid tied life size mockup utilizing the actual components of a grid tied PV system: PV module, PV combiner box, inverter, disconnects, metering, grounding.

ELY 290 Wind Turbine Technology and Other Renewable Energy Sources

4 Class Hours, 4 Quarter Credit Hours

Corequisites: ELY 283, SCI 110

Prerequisites: Students in Electrical Technology with Renewable Energy (ELRE) must achieve a cumulative grade point average of 2.50 throughout the program and hold their OSHA card in order to enter the seventh quarter of the program. This course focuses on wind power and explores other renewable energy sources, such as hydro-electric. Students will examine turbine components, installation, power in the wind, environmental impact, maintenance, practicality, site sustainability, and local regulations. The installation of NEIT's 100kw wind turbine will also be studied including the data provided by on-line live monitoring of turbine. Students will also participate in a quarter long project culminating with group presentations on the pros and cons of fossil fuels, including nuclear, versus various renewable energy fuels. Students will also complete hands on exercises to explore some of the wind technology topics.