Curriculum Framework for Electrician

CIP Code: 46.0302

Initial Review Date: 10/01/2022

Eligibility Dates: 10/01/2022 – 10/01/2030

Credit Award: 20.5 Credits

Course Equivalencies:

Electrical	Credits	TESU Course Equivalent	Effective Dates	For Staff Use
Electrical Program	3	ELE-2120	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	3	ELE-1110	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	1.5	CET-1150	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	3	ELE-2210	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	3	ELE-1410	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	3	ELE-2250	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	3	ELE-2410	10/1/2022 – 10/1/2030	CCTS.ELEC
Electrical Program	1	APS-2100	10/1/2022 – 10/1/2030	CCTS.ELEC

Gaining Access to the Evaluated Credit Award

The following curriculum was evaluated by Thomas Edison State University (TESU) through its Professional Learning Review (PLR) Process to determine college-credit equivalency for the training program.

The current state approved Career and Technical Education (CTE) programs in New Jersey that have been verified to follow this curriculum, and to be eligible to receive TESU credit upon completion can be found on the Verification Letter.

Question: How does your CTE program become eligible for this credit award for your students?

Answer: To become eligible, and to have your school's name listed on the Verification Letter, please follow these instructions:

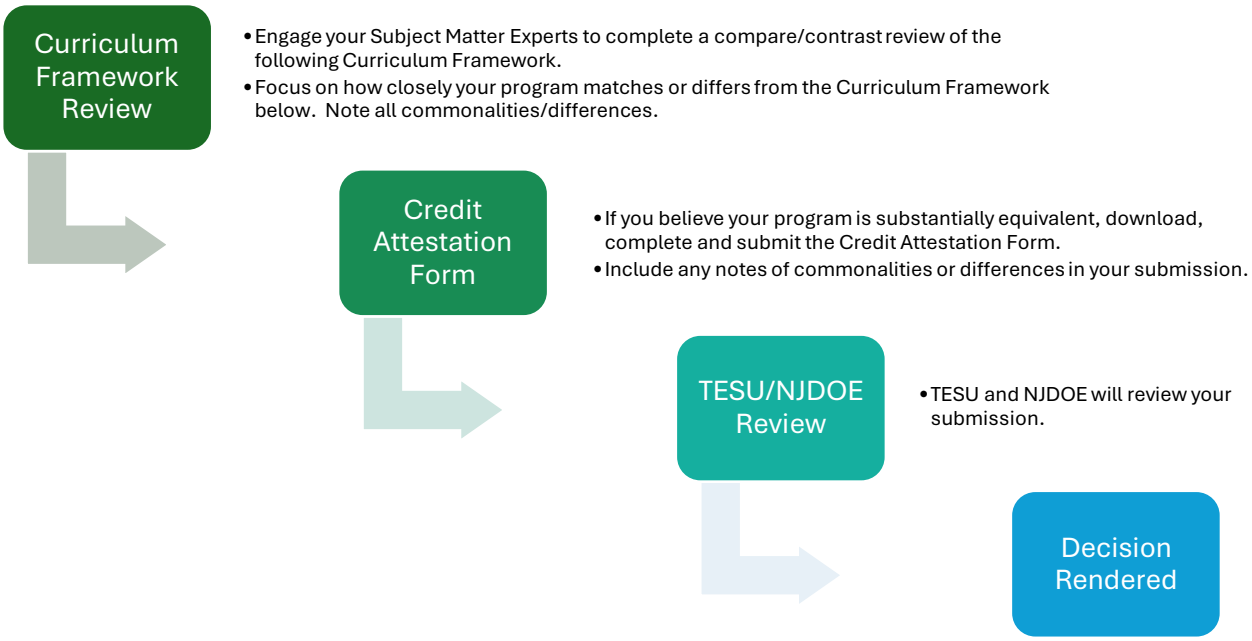
Step 1. Review the following Curriculum Framework and compare it against your school's current state approved CTE program. TESU suggests utilizing your school's subject matter experts for this compare/contrast review. The GOAL of your review is to ensure that the training program in place at your school matches the evaluated program.

Step 2. Complete/Download the Credit Attestation Form for this program on TESU's website.

Step 3. Complete the Credit Attestation Form and email it to plr@tesu.edu.

Step 4. TESU will review the contents and share the attestation form information with the New Jersey Department of Education (NJDOE) for approval.

Step 5. Once approved by TESU and the NJDOE, you will be notified and an updated Verification Letter will be added to the TESU website for this program.



If you have any questions, or if your compare/contrast review is close but off a little, please contact us at plr@tesu.edu.

Curriculum Framework

Approved Program Name: Electrician

CIP Code: 46.0302

Length of Program: 4 Years / 1600 Hours

Credit Award: 20.5 Credits

Course Equivalencies:

Electrical	Credits	TESU Course Equivalent	Effective Dates	For Staff Use
Electrical Program	3	ELE-2120	10/1/2022 – 10/1/2030	CCTS.ELEC
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Electric Level I

The review team found that the Electric Level I curriculum provides a substantial foundation in both theoretical and applied aspects of electrical work. The program emphasizes hands-on training and essential safety protocols, contributing meaningfully to the development of practical competencies that can enhance the effectiveness and employability of university graduates.

While there are notable differences in scope and depth when compared to traditional Electrical Technology or Electrical Engineering degree programs, such distinctions are expected, given the varying professional pathways these programs are designed to serve. Nevertheless, the Electric Level I curriculum demonstrates academic merit and offers a coherent structure, with content scaffolded across the instructional sequence. Learning outcomes are clearly defined and measurable, and the associated assessments align appropriately with these outcomes. Instructional time allocated for each module is deemed sufficient for the intended learning to occur.

The curriculum advances from foundational principles to more specialized topics commonly covered in associate-level Electrical Technology programs. Key areas of instruction include:

- Electrical Safety
- Introduction to Electrical Circuits
- Electrical Theory
- Introduction to the National Electrical Code (NEC)
- Basic Electrical Construction Drawings
- Residential Electrical Services

These core topics align closely with lower-division college-level coursework in Electrical Technology. Additional topics not listed here were also evaluated and contributed to the comprehensive knowledge base acquired in the course. The full scope of content informed the credit recommendation made by the team.

Electric Level II

The review team determined that the Electric Level II curriculum is well-constructed and reflects best practices consistent with academic standards set by accrediting bodies. Instructional content progresses logically from introductory to intermediate concepts, supported by clearly articulated learning objectives and measurable outcomes. Assessments are appropriately aligned, and the time designated for each instructional segment is sufficient to support student success. Students use the knowledge gained in Electric I and apply it to residential dwelling electrical construction.

A detailed review of the curriculum materials affirmed that the outcomes are rigorous and relevant at both the course and module levels. Instructional pacing and content coverage are appropriate for the complexity of the subject matter.

The curriculum advances the learner's knowledge into more specialized and technical domains within the electrical field. Topics relevant to associate-level Electrical Technology education were identified, including:

- Alternating Current
- Motors: Theory and Application
- Electric Lighting
- Control Systems and Fundamental Concepts

These topics reinforce foundational competencies and provide the theoretical and practical grounding necessary for success in more advanced coursework. The review team concluded that the course justifies the awarding of academic credit toward an associate degree in Electrical Technology.

Electric Level III

The review team found that Electric Level III reflects continued advancement in content complexity and academic rigor. Students are expected to apply core principles to solve problems, explain processes, and engage in increasingly sophisticated applications. The curriculum demonstrates strong instructional coherence, with lessons and assessments designed to build sequentially and support deeper learning (i.e., curricular threading). Learning outcomes are measurable, clearly linked to course objectives, and attainable within the instructional timeframe and delivery methods (e.g., lectures, labs, assessments).

Students build on the knowledge gained in Electric I and II by focusing on projects and conditions present on commercial sites.

The primary areas of focus include electric circuits, motors and controls, transformers, and electrical wiring. Specific topics such as motor calculations and controls, electrical load calculations, overcurrent protection, and practical lighting applications are directly aligned with lower-division college coursework.

These concepts form the backbone of associate-level courses such as:

- Motors & Controls
- Programmable Logic Controllers
- Power Electronics
- Industrial Controls

The mastery of content in Electric Level III establishes a solid foundation for progression into these more advanced topics, reinforcing the team's recommendation for credit at the associate degree level.

Electric Level IV

The review team concluded that Electric Level IV serves as a culminating course that integrates and applies prior learning to complex, real-world scenarios. The curriculum demonstrates a high degree of alignment with the earlier modules in the series. Students engage in problem-solving, leadership tasks, and advanced technical exercises requiring the integration of previously acquired knowledge. Instruction emphasizes application and analysis across content domains including electrical circuits, motors and controls, HVAC systems, and electrical construction leadership. Advanced topics addressed include:

- Motor Operation and Maintenance
- Electric Load Calculations
- Basic Electronic Theory
- HVAC and Advanced Control Systems
- Specialty Transformers
- Fire Alarm Systems
- Fundamentals of Crew Leadership

The course design, content scope, and instructional methods are consistent with university-level expectations. The team affirms that successful completion of Electric Level IV, when combined with prior coursework in the program, justifies the awarding of academic credit in alignment with lower-division associate degree requirements in Electrical Technology.

OSHA-10

All Electric Program students complete OSHA-10 training. Students who complete OSHA-10 are eligible to receive 1 credit in APS-2100 through a previously conducted Professional Learning Review at Thomas Edison State University. This is included in the credit recommendations.

Program Exhibit

Course Title: Electric Program

Modality/Location(s): In-person

CIP Code: 46.0302

Length: 4 years, 1,600 hours

Description: Students in the Electric program learn industrial, commercial, and residential wiring in accordance with the National Electrical Code. Job safety is stressed throughout the program. Instruction includes basic electrical theory as it pertains to direct and alternating currents. Over their four years, students receive numerous hands-on experiences doing live lab projects. Students perform practical applications with pipe bending, conduits, and fittings, conductor installations, residential services, distribution equipment and transformers, HVAC and alarm systems. Training includes several related green technologies and practices in the electric field.

Learning Outcomes:

Electric I

Electrical Careers, Trades and Safety Requirements

- Identify classifications of the electrical trade
- Understand apprenticeship programs of the electrical trade
- Understand the responsibilities of a journeyman electrician
- Understand the benefits offered in the electrical trade
- Understand the electrical licensing of New Jersey
- Identify safety hazards
- Recall shop safety rules
- Relate safety rules to hand tool use
- Recall electrical shock path theory
- Identify major causes of electrical hazards
- Summarize safety rules and procedures on unit safety test
- Identify hazardous shock points
- Recognize need for safety glasses, PPE, insulated tools while working on energized equipment
- Understand the importance of removing power when working on equipment and devices

Electrical Fundamentals and Theory

- Identify and list the fundamental properties of matter
- Describe the structure of an atom
- Compare differences between conductors vs insulators
- Compare the difference between ferrous and non-ferrous metals & their unique and different properties
- Identify the 4 main electrical units and analyze how they relate to each other in different circumstances. Volts, Amps, Ohms, Watts
- Describe & apply Ohm’s & Watts Laws
- Complete calculations and equations related to Ohm’s & Watt's Laws
- Describe the characteristics & functions of a series circuit
- Describe the basic relationship of voltage, current and resistance in a series circuit

- Apply Ohm’s & Watt's Laws to a series circuit
- Describe the characteristics & functions of a parallel circuit
- Describe the relationship of voltage, current and resistance in a parallel circuit
- Apply Ohm’s & Watts's Law to a parallel circuit

Introduction to Hand Tools and Materials

- Describe and know how to properly operate the basic functions of basic electrical testing tools, including digital multi-meters
- Describe and demonstrate the specific purpose for each hand tool
- Use electricians’ hands tools in a safe manner
- Explain how to properly maintain their hand tools
- Identify enclosures and boxes used in the electrical trade
- Explain use of boxes used in electrical trade
- Identify basic residential switches and receptacles
- Identify conductors by their "Marking"
- Describe conductor sizing (AWG)
- Describe and be able to identify UL listing of electrical equipment
- Identify the correct boxes for the correct application
- Identify and use various fasteners, their sizes and correct application
- Identify the sizes and number of conductors in NM (Romex) and low voltage control cables

Splices and Low Voltage Circuits

- Identify and use the proper wire nuts based on conductor size
- Summarize and complete splicing techniques and sequence
- Complete a splice using crimp connectors
- Complete a splice of large conductors using split-bolts and tap connectors
- Complete process of how to insulate split-bolts and tap connectors with electrical tape and rubber splicing tape
- Apply Ohm’s Law to a series circuit
- Apply Ohm’s Law to a parallel circuit
- Apply Ohm’s Law to a combination circuit
- Use digital multi-meters to measure volts, amps and ohms
- Construct a cord and plug
- Articulate and show how to correctly wire a "step down" transformer
- Employ series, parallel and combination circuits to operate low voltage signaling devices
- Show how to wire a "switch loop" using 2 conductor bell cable

Electric II

Fundamentals and Planning

- Identify the type of prints an electrician may read
- Recognize the different schedules in electrical drawings
- Identify the lines & symbols used in electrical drawings
- Read and apply "scale" used on blueprints
- Be able to apply NEC requirements to an electrical installation
- Interpret electrical drawings, site plans, floor plans, and detail drawings
- Identify the required locations of switches and receptacles
- be able to space dwelling receptacles according to NEC
- Be able to calculate the floor area of dwelling
- Be able to determine the number of small appliance branch circuits
- Be able to explain lighting requirements for rooms, hallways, stairways & entrances

Basic Residential Installation

- Install NM Cable (Romex)
- Install single pole switches
- Install 3-way switches
- Install 4-way switches
- Install device new work boxes
- Install old work boxes in drywall
- Install duplex receptacles
- Install split-wired receptacles
- Install a lighting fixture
- Install heating circuits
- Install air conditioning circuits & disconnects
- Install faceplates so they are level and plumb
- Be able to wire a GFCI receptacle
- Be able to wire a GFCI receptacle to protect downstream receptacles
- Be able to properly bond a metal device box
- Install outdoor "Bell Boxes" suitable for wet locations
- Install "Bubble"/In-use covers suitable for wet locations
- Be able to select the proper OCPD for a particular conductor size

Introduction to Power Tools

- Identify power tool use
- Be able to safely use a power drill
- Be able to select the proper drill bit for the substrate
- Be able to safely use a hammer drill
- Be able to safely use an impact driver
- Be able to safely use a SawZall
- Be able to safely use a portable band saw
- Be able to safely use a circular saw

- Be able to safely use a flush cut saw
- Be able to safely use an angle grinder

Residential Services

- Know how to calculate loads for circuits
- Apply demand factors based on NEC requirements
- Know how to determine electric service requirements for dwellings
- Calculate loads for lighting, appliances, heating & air conditioning
- Be able to compute loads and select proper conductor sizes for electric ranges, wall-mounted ovens & counter-mounted cooking equipment
- Perform a residential load calculation as regulated by the NEC
- Size a neutral conductor for a single-family residential service based on load factors
- Size a grounding electrode conductor for a single-family residential service based on service size
- Be able to install a branch circuit OCPD
- Be able to install a service panel
- Be able to install a meter socket
- Install a service entrance with a weatherhead
- Understand electrical service grounding
- Recognize the options for grounding electrode conductors
- Describe overcurrent protection options for conductors & equipment

Electric III

Advanced Electrical Theory and Fundamentals

- Describe the difference between single phase and 3-phase electric current & voltages
- Describe the 5 primary AC voltages supplied by the power utilities
- Understand the purpose and necessity of the grounded conductor
- Describe the differences between RMS, effective & peak voltage
- Understand & describe why 3-phase electricity is more efficient than single phase electricity
- Describe inductive resistance and distinguish how it is different from pure resistance

Commercial Materials

- Determine the size and type of conduit required for a particular electrical installation
- Determine what electrical devices, enclosures and conduits are permitted in various environments
- Identify electrical fittings
- Identify electrical raceways
- Calculate raceway conductor fill
- Identify proper raceway applications
- Identify raceways

Commercial Wiring Methods

- Properly cut and install MC Cable
- Understand conduit bending "gain"
- Understand the markings of a conduit hand bender
- Know how to calculate and make a 90-degree hand bend
- Know how to calculate and make a "Back-to-Back" bend
- Know how to calculate and make bend offsets at various angles
- Know the multiplier for offset bends
- Know how to calculate and make 3- and 4-point saddle bends
- Know how to calculate and make "Kick" bends
- Know how to calculate and make conduit bends using a hydraulic bender
- Know how to install PVC Rigid conduit
- Know how to calculate and make bends using PVC Rigid Conduit
- Know how to install Liquidtight Flexible Metal Conduit
- Know how to install Liquidtight Non-Flexible Metal Conduit
- Know how to install surface metal raceway
- Know how to properly cut and ream Rigid Metal Raceway
- Know how to properly cut threads into Rigid Metal Raceway
- Understand & know how to utilize unistrut for securing conduit, panels & enclosures

Commercial Equipment and Lighting Systems

- Repair HID lights
- Repair fluorescent lights
- Recognize and identify light colors by their color temperature (Kelvins)
- Change a fluorescent lighting ballast

- Convert fluorescent lights to accept LED tubes
- Understand how to read a nameplate from equipment to identify electrical requirements

Electric IV

Three-Phase and Auto Transformers

- Identify the purpose and function of a transformer based on its nameplate
- Wire a "Step-Up" and a "Step-Down" transformer
- Properly ground a transformer
- Wire and utilize an auto transformer for different voltages

Motors

- Identify the critical characteristics of particular motors
- Wire a motor to a particular voltage
- Reverse the rotation of a single phase motor
- Reverse the rotation of a 3 phase motor
- Change a motor capacitor
- Troubleshoot a motor failure

Motor Controls

- Read a ladder diagram
- Read a wiring schematic
- Wire a 3-Phase magnetic overload motor starter
- Troubleshoot a failure in a magnetic motor starter
- Wire a 3-Phase electronic overload motor starter
- Wire a "3-wire" Start/Stop pushbutton station
- Wire timing relays
- Utilize and wire 8 & 11 pin control relays
- Reverse a motor using 2 different motor starters
- Wire pilot devices such as limit, pressure, flow, float and temperature switches
- Utilize a control relay as a "Holding Contact"
- Properly size and install thermal overloads

End of Curriculum Framework

Suggested Degree Programs at TESU

- Associate of Science (A.S.) in Electrical Technology
- Associate of Science (A.S.) in Technical Studies
- Bachelor of Science (B.S.) in Electronics Systems Engineering Technology
- Bachelor of Science (B.S.) in Electrical Technology
- Bachelor of Science (B.S.) in Energy Systems Technology
- Bachelor of Science (B.S.) in Technical Studies

For more information, please contact Thomas Edison State University's Professional Learning Review Office via email at plr@tesu.edu.