# Scope & Sequence

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| Course Name: Electrical Technology I **PEIMS Code:** 13005600 | | | **Course Credit:** 1.0  **Course Requirements:** This course is recommended for students in Grades 10-12.  **Prerequisites:** None.  **Recommended Prerequisites:** Principles of Architecture and Construction. |
| **Course Description:** In Electrical Technology I, students will gain knowledge and skills needed to enter the workforce as an electrician or building maintenance supervisor, prepare for a postsecondary degree in a specified field of construction or construction management, or pursue an approved apprenticeship program. Students will acquire knowledge and skills in safety, electrical theory, tools, codes, installation of electrical equipment, and the reading of electrical drawings, schematics, and specifications. | | | |
| **NOTE:** This is a suggested scope and sequence for the course content. This content will work with any textbook or instructional materials. If locally adapted, make sure all TEKS are covered. | | | |
| **Total Number of Periods**  **Total Number of Minutes**  **Total Number of Hours** | 175 Periods  7,875 Minutes  131.25 Hours\* | \*Schedule calculations based on 175/180 calendar days. For 0.5 credit courses, schedule is calculated out of 88/90 days. Scope and sequence allows additional time for guest speakers, student presentations, field trips, remediation, extended learning activities, etc. | |
| **Unit Number, Title, and Brief Description** | **# of Class Periods\***  (assumes 45-minute periods)  Total minutes per unit | **TEKS Covered**  **130.57 Knowledge and Skills** | |
| **Unit 1: Career Development**  Students will identify interests, abilities, aptitudes, values, and personality traits as they relate to career planning, to develop a keen understanding of the value and benefit of work, and to differentiate between jobs and careers. This unit will help students better understand the various career opportunities within the Architecture and Construction industry. Students will develop a career plan designed to achieve their career goals within this industry. Students will explore the job titles, job expectations, salaries, education needed and forecast for the industry. | 10 Periods  450 Minutes | 1. The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:  (A) identify job opportunities with their accompanying job duties such as electrician, building maintenance technician, manager, and electrical engineer; and  (B) research career pathways, including education, job skills, and experience required to achieve that pathway | |
| **Unit 2: Industry Regulations, Compliance, and Workplace Safety**  This unit will expose students to the important compliance, safety standards, and regulations that are implemented within this industry. Students will learn that such practices are in place to manage resources to minimize losses and liabilities to businesses in the industry. Students will determine the role of risk management in the construction industry including, but not limited to, discussions focusing on liability insurance, sanitation, OSHA and EPA regulations, emergency situations, building code, MSDS, and security issues. | 10 Periods  450 Minutes | 2. The student identifies the issues associated with electrical hazards found on a jobsite. The student is expected to:  (A) demonstrate safe working procedures in a construction environment;  (B) explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job;  (C) identify electrical hazards and how to avoid or minimize them in the workplace; and  (D) explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, confined space entry, respiratory protection, and fall protection | |
| **Unit 3: Basic Electrical Theory**  This unit will include lessons on terminology and skills that are associated with mathematics and science knowledge specifically pertaining to electrical technology. Students will differentiate between types of circuits including series, parallel, and combined series-parallel. Students will understand and apply electrical concepts such as voltage, current, resistance, and power. Students will focus on understanding, interpreting, analyzing and knowing how to correctly use electrical formulas, units of measure, mathematics concepts, and science principles in order to solve problems. | 20 Periods  900 Minutes | 5. The student learns the electrical concepts used in Ohm's law applied to direct current and series circuits and understands series parallel circuits, resistive circuits, Kirchhoff's voltage and current laws, and circuit analysis. The student is expected to:  (A) recognize what atoms are and what atoms are composed of;  (B) define voltage and identify the ways in which it can be produced;  (C) explain the difference between conductors and insulators;  (D) define the units of measurement used to measure the properties of electricity;  (E) explain how voltage, current, and resistance are related to each other;  (F) calculate an unknown value using the formula for Ohm's law;  (G) explain the different types of meters used to measure voltage, current, and resistance;  (H) calculate the amount of power used by a circuit using the power formula;  (I) explain the basic characteristics of a series, parallel, and combined series-parallel circuit;  (J) calculate, using Kirchhoff's current law, the total current in parallel and series-parallel circuits; and  (K) find the total amount of resistance in a series, parallel, or combined series-parallel circuit | |
| **Unit 4: National Electric Code**  Students will research the current National Electrical Code (NEC), National Electrical Manufacturers Association Code (NEMA), and National Fire Protection Association Code (NFPA), and Underwriters Laboratories (UL) Standards. Students will demonstrate the use of electrical codes and specifications by properly navigating NEC. Students will describe and explain the role of NEMA, NFPA and testing laboratories in the electrical industry. | 10 Periods  450 Minutes | 7. The student uses the National Electrical Code. The student is expected to:  (A) explain the purpose and history of the National Electrical Code;  (B) describe the layout of and explain how to navigate the National Electrical Code;  (C) describe the purpose of the National Electrical Manufacturers Association and National Fire Protection Association; and  (D) explain the role of testing laboratories | |
| **Unit 5: Drafting and Design**  Students will differentiate between the different building trades’ plans and specifications. Students will demonstrate the use of lines and read and interpret basic codes. Students will compare differences in symbols and abbreviations between the building trades including electrical, mechanical, and plumbing. Students will read and interpret plans, elevations, schedules, sections, and details contained on basic construction drawings. Students will analyze site plans, floor plans, and detail drawings to determine the electrical specifications and equipment schedules included on them. Within this unit students gain knowledge related to construction drawings, architectural scale & measuring tools, residential construction drawings, and commercial construction drawings. Additionally, students will learn about drafting lines, drawing symbols, analyzing drawings, power plan, lighting plan, and important details and diagrams. | 10 Periods  450 Minutes | 10. The student learns electrical symbols and their use in design drawings. Additionally, students learn to interpret schematics, one-line diagrams, and wiring diagrams. The student is expected to:  (A) explain the basic layout of a design drawing;  (B) describe the information included in the title block of a drawing;  (C) identify common symbols and the various types of lines used on drawings;  (D) understand the use of architect's and engineer's scales;  (E) interpret electrical drawings such as site plans, floor plans, and detail drawings;  (F) read equipment schedules found on electrical drawings; and  (G) describe the type of information included in electrical specifications | |
| **Unit 6: Conduit**  Students will gain the knowledge regarding conduit bending, hand bending equipment, conduit bending geometry, bending a 90 degree elbow, making offset bends, making saddle bends, and joining metallic conduits. Students will also gain the knowledge related to cutting, reaming and threading metal conduit, non-metallic sheathed cable, and bending PVC conduit. Students will accurately use mathematical formulas to determine proper conduit bends. | 20 Periods  900 Minutes | 3. The student learns conduit bending and installation. The student is expected to:  (A) identify the methods of hand bending conduit;  (B) identify the various methods used to install conduit;  (C) use mathematical formulas to determine conduit bends;  (D) make 90 degree bends, back-to-back bends, offsets, kicks, and saddle bends using a hand bender; and  (E) cut, ream, and thread conduit | |
| **Unit 7: Conductors and Wiring**  In this unit students will learn about conductors, including the concepts of sizing conductors, temperature limitations, conductor correction factors, conductor selection, grounded conductors, grounding conductors, and ungrounded conductors. Students will be able to differentiate between the characteristics and functionality of various wires and conductors. Students will also be introduced to installing conductors in raceways, conduit fill, and preparing conductors for conduit installation. | 20 Periods  900 Minutes | 9. The student learns the types and applications of conductors and wiring techniques. The student is expected to:  (A) demonstrate the various wire sizes using a wire in accordance with American Wire Gauge standards;  (B) identify insulation and jacket types according to conditions and applications;  (C) describe voltage ratings of conductors and cables;  (D) read and identify markings on conductors and cables;  (E) use the tables in the National Electrical Code to determine the ampacity of a conductor;  (F) state the purpose of stranded wire;  (G) state the purpose of compressed conductors;  (H) describe the different materials from which conductors are made;  (I) describe the different types of conductor insulation;  (J) describe the color coding of insulation;  (K) describe instrumentation control wiring;  (L) describe the equipment required for pulling wire through conduit;  (M) describe the procedure for pulling wire through conduit;  (N) install conductors in conduit; and  (O) pull conductors in a conduit system. | |
| **Unit 8: Raceways**  Students begin this unit learning about various types of cable trays and raceways. Students will identify raceway fittings, body sizes, as well as seal fittings, fasteners and anchors to secure raceways. Students will also learn about wire ways, storing and handling raceways, and construction methods for raceways. Students will describe National Electrical Code requirements for raceways, and the proper procedure for their installation on varying surfaces (brick, metal, wood, and drywall). | 20 Periods  900 Minutes | 8. The student learns the types and applications of raceways, wireways, and ducts. The student is expected to:  (A) describe various types of cable trays and raceways;  (B) identify and select various types and sizes of raceways;  (C) identify and select various types and sizes of cable raceways;  (D) identify and select various types of raceway fittings;  (E) identify various methods used to install raceways;  (F) demonstrate knowledge of National Electrical Code raceway requirements;  (G)describe procedures for installing raceways and boxes on masonry surfaces, metal stud systems, wood-framed systems, and drywall surfaces; and  (H)recognize safety precautions that must be followed when working with boxes and raceways | |
| **Unit 9: Electrical Hardware and Support Systems**  Students will identify and explain the use of threaded and non-threaded fasteners, and anchors for proper electrical system installation. Students will demonstrate recognition and use of correct fasteners and anchors for different electrical system installation projects. | 15 Periods  675 Minutes | 4. The student gains knowledge of the hardware and systems used by an electrician to mount and support boxes, receptacles, and other electrical components. The student is expected to:  (A) identify and explain the use of threaded fasteners;  (B) identify and explain the use of non-threaded fasteners;  (C) identify and explain the use of anchors;  (D) demonstrate the correct applications for fasteners and anchors; and  (E) install fasteners and anchors | |
| **Unit 10: Electrical Test Equipment**  Students will demonstrate proper use of various test equipment including ammeter, voltmeter, volt-ohm-multimeter, voltmeter, frequency meter, and continuity tester. Students will gather data from test equipment with both digital and analog displays. between their data displays. Students will apply a working knowledge of the math needed to calculate amperage, voltage, wattage, and resistance. | 10 Periods  450 Minutes | 6. The student gains knowledge in selecting, using, and safely maintaining common electrical test equipment. The student is expect to:  (A) explain how to operate test equipment such as ammeter, ohmmeter, volt-ohm-multimeter, continuity tester, and voltage tester;  (B) explain how to read specific test equipment and convert from one scale to another when using specified test equipment;  (C) explain the importance of proper meter polarity; and  (D) explain the difference between digital and analog meters | |
| **Unit 11: Commercial and Industrial Wiring**  Students will identify different types of electrical controls including switches, receptacles, relays, and switchgear. Students will interpret NEMA classifications and NEC requirements pertaining to switches, enclosures, electrical boxes, and wiring devices. Students will demonstrate the proper and safe use of electrical tools and connectors to install electrical devices including striping and splicing wire together. | 15 Periods  675 Minutes | 11. The student learns the electrical devices and wiring techniques used in commercial and industrial construction and maintenance. The student is expected to:  (A) identify and state the functions and ratings of special switches such as single-pole, double-pole, three-way, four-way, dimmer, and safety switches;  (B) explain National Electrical Manufacturers Association classifications as they relate to switches and enclosures;  (C) explain the National Electrical Building Code requirements concerning wiring devices;  (D) identify and state the functions and ratings of wiring devices such as straight blade, twist lock, and pin and sleeve receptacles;  (E) identify and define receptacle terminals and disconnects;  (F) identify and define ground fault circuit interrupters;  (G) explain the box mounting requirements in the National Building Code;  (H) use appropriate tools and connectors to strip and splice wires together;  (I) identify and state the functions of limit switches and relays; and  (J) identify and state the function of switchgear | |
| **Unit 12: Residential Wiring**  Students will understand and describe the technical aspects of residential wiring including details such as single phase – 120 voltage, grounding requirements, sheath insulation, etc. and how they are meant to protect residents from electrical shock. Students will learn service conductor calculations, determining square footage of a dwelling, and computing branch circuit loads. Students will describe the proper installation of electrical systems for HVAC units, swimming pools and spas, as well as light fixtures. | 15 Periods  675 Minutes | 12. The student learns the electrical devices and wiring techniques used in residential construction maintenance. The student is expected to:  (A) describe how to determine electric service requirements for dwellings;  (B) explain the grounding requirements of a residential electric service;  (C) calculate and select service-entrance equipment;  (D) select the proper wiring methods for various types of residences;  (E) explain the role of the National Electrical Code in residential wiring;  (F) compute branch circuit loads and explain their installation requirements;  (G) explain the types and purposes of equipment grounding conductors;  (H) explain the purpose of ground-fault circuit interrupters and tell where they must be installed;  (I) determine the size of outlet boxes and select the proper type for different wiring methods;  (J) describe rules for installing electric space heating and heating, ventilating, and air conditioning equipment;  (K) describe the installation rules for electrical systems around swimming pools, spas, and hot tubs;  (L) describe the installation and control of lighting fixtures; and  (M) explain how wiring devices are selected and installed | |