

ELECTRICAL TECHNOLOGY

Program of Studies
2015-2016

TRACK ONLY



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Electrical Technology

Course Title	Post-Secondary Connection	Valid Course Code	Recommended Grade Level				Recommended Credit
			9	10	11	12	
Basic Blueprint Reading	BRX 120	499920	X	X	X	X	.5
Basic Troubleshooting		499925	X	X	X	X	1
Circuits I	ELT 110	460316	X	X	X	X	1 to1.5
Circuits II	ELT 114	460319		X	X	X	1 to1.5
Co-op (Electrical)	EET 299	460345			X	X	1
Electrical Construction I	EET 154/155	460312	X	X	X	X	1
Electrical Construction II	EET 252/253	460313		X	X	X	1
Electrical Motor Controls	EET 270/271	460331		X	X	X	1
Industrial Safety	ISX 100	499930	X	X	X	X	.5
Internship (Electrical)	EET 299	460348			X	X	1
National Electrical Code	EET 250	460339		X	X	X	.5
Renewable Energy Systems		460342		X	X	X	1
Renewable Energy System (Special Problems)		460344			X	X	.5
Rotating Machinery	EET 264/265	460323		X	X	X	1
Rotating Machinery Electrical Motor Controls	EET 268/269	460325		X	X	X	1
Special Problems – Electrical Technology	EET 281	460377		X	X	X	1
Special Topics – Electrical Technology		460399		X	X	X	.5 to 1
Sustainable Energy Systems		460340		X	X	X	1
Transformers	EET 150/151	460305		X	X	X	1

ELECTRICAL TECHNOLOGY

Program Description

The Electrical Technology program will provide students with the foundation to become effective electrical workers in the residential, commercial, and industrial fields. Course offerings may include the study of electrical systems in residential wiring, commercial wiring, and industrial motor controls with study in new construction, remodel, and the industrial and commercial industries. Course offerings include everything from entry level trades courses, all the way to national certification. Students will train at the career centers, high schools and at real jobsites. Current and traditional building practices are included, while updated and advanced electrical techniques are emphasized.

Course offerings are intended to promote career pathways for those just entering the industry, as well as industry professionals looking to stay current. There are multiple certificates and degree options and inter-related disciplines at the Career Centers having articulation agreements with various post-secondary institutions.

Career centers may also offer pre-apprenticeship career pathway opportunities into registered apprenticeship programs to secondary students. This is a business and industry driven program to create a pipeline for students to enter post-secondary apprenticeship training.

Students who successfully complete this program may seek entry-level employment as an Electrician Assistant, Industrial Electrician Assistant, Residential Electrician, or be awarded an industry certification through the Kentucky Labor Cabinet, dependent upon which career pathway is offered.

ELECTRICAL TECHNOLOGY CAREER PATHWAYS 2015-2016

CONSTRUCTION - ELECTRICAL -- TRACK CIP 46.0302.99

PATHWAY DESCRIPTION: The Construction Electrical TRACK is designed as a pre-apprenticeship program to provide career pathway opportunities into registered apprenticeship programs for secondary students and creates a pipeline for students to enter post-secondary apprenticeship training. This program prepares individuals to apply technical knowledge and skills to install, operate, maintain, and repair electric apparatus and systems in residential, commercial, and industrial electric-power wiring, DC and AC motors controls, and electrical distribution panels. Includes instruction in the principles of electronics and electrical systems, wiring, power transmission, safety, industrial and household appliances, job estimation, electrical testing and inspection, and applicable codes and standards. Each student must pass an End of Program assessment and complete eight OSHA safety modules listed on the “Track” website (<http://www.laborcabinetetrain.ky.gov/track.html>) to be eligible to receive credit and preference in an organization that sponsors a registered apprenticeship program. Course credit will be considered at the discretion of training provider (grades and attendance can be taken into consideration).

BEST PRACTICE CORE

EXAMPLE ILP-RELATED CAREER TITLES

*Foundational Skills Necessary for Career-Ready Measure:
(KOSSA/Industry Certification)*

*Complete (4) **FOUR CREDITS:***

- [460312](#) Electrical Construction I
- [460313](#) Electrical Construction II
- [460316](#) Circuits I
- [460319](#) Circuits II

Note: (*) Indicates half-credit course

Electrical Engineer
Electrical Engineering
Tech
Electrician

The Tech Ready Apprentices for Careers in Kentucky (*TRACK*) pre-apprenticeship program is a partnership between The Kentucky Department of Education’s Office of Career and Technical Education and The Kentucky Labor Cabinet to provide pre-apprenticeship career pathway opportunities into registered apprenticeship programs to secondary students. This is a business and industry driven program to create a pipeline for students to enter post-secondary apprenticeship training.

Upon successful completion, the student will be awarded an industry certification by the employer or training organization through The Kentucky Labor Cabinet and all on-the-job hours worked will be counted towards the apprenticeship, if applicable. The certification will also count towards the local school district’s college and career ready accountability index.

The specifics of the TRACK program vary and interested parties will need to confer with the Office of Career and Technical Education for the implementation process. There are no costs involved except wages for the student employee. The employer must have a registered apprenticeship program with The Kentucky Labor Cabinet. For more information, please refer to:

<http://education.ky.gov/CTE/cter/Pages/TRACK.aspx>

As career pathways continue to expand, the ultimate rationale is that if an employer is willing to implement a Registered Apprenticeship program, a pipeline at the secondary level can be developed utilizing the TRACK program.

Electrical Construction I

460312

Course Description	
Involves the study of materials and procedures used in construction wiring.	
Content/Process	
	<i>Articles are referenced from the latest version of the National Electric Code (NEC)</i>
1	<p>Workplace Safety and Knowledge:</p> <ul style="list-style-type: none"> a) Identify equipment and materials of the trade b) Identify safe and proper use of tools of the trade c) Identify the characteristics of a safe work site d) Identify OSHA's 1926.10 Construction Standards and who enforces OSHA Rules and Regulation in Kentucky e) Identify and use personal protective equipment f) Demonstrate ladder safety g) Demonstrate electrical safety (i.e., GFCI, cord use, grounding) h) Identify different types of chemical, biological, and physical hazards i) Interpret hazardous chemical communication (i.e., MSDS, HAZWOPER) j) Demonstrate knowledge and understanding of blood borne pathogens k) Demonstrate knowledge and understanding of blueprints (i.e., symbols, specifications, layout) l) Demonstrate knowledge and understanding of schematics and line diagrams
2	<p>MATH AND SCIENCE OF ELECTRICITY:</p> <ul style="list-style-type: none"> a) Demonstrate an understanding of Ohm's Law b) Demonstrate an understanding of DC Circuits c) Demonstrate an understanding of AC Circuits d) Demonstrate an understanding of transformers
3	<p>WIRING METHODS AND MATERIALS - National Electrical Code Articles 300 – 399:</p> <ul style="list-style-type: none"> a) Exhibits previously learned knowledge of general wiring methods and materials b) Locates information using conductors for general wiring c) Demonstrates an understanding of conductors for general wiring d) Apply knowledge of outlet, device, pull, and junction boxes; conduit bodies; fittings; and handhole enclosures e) Apply knowledge of cables according to the National Electrical Code (320-340) f) Apply knowledge of raceways according to the National Electrical Code (342-399)

	<p>EQUIPMENT FOR GENERAL USE - National Electrical Code Articles 400 – 490:</p> <ul style="list-style-type: none"> a) Interpret code regulations of equipment for general use (i.e., cords, switches, fixtures) b) Apply knowledge of luminaires, lampholders, and lamps c) Apply knowledge of appliances and equipment 	
4	<p>WIRING AND PROTECTION - National Electrical Code Articles 200 – 285:</p> <ul style="list-style-type: none"> a) Exhibits use and identification of grounded conductors b) Interpret code regulations of branch circuits c) Interpret code regulations of feeders d) Apply branch-circuit, feeder, and service calculations e) Interpret code regulations of services f) Calculate overcurrent protection g) Interpret code regulations of grounding and bonding 	
5	<p>GENERAL - National Electrical Code Articles 100 – 110:</p> <ul style="list-style-type: none"> a) Exhibits previously learned material by recalling facts, terms, and basic concepts related to the National Electrical Code b) Locates information using electrical installations regulation c) Demonstrates an understanding of electrical installations regulation 	
6	<p>Electrical Construction I:</p> <ul style="list-style-type: none"> a) Draw wiring diagrams to specifications b) Compile a bill of materials from wiring diagrams drawn to specifications c) Estimate total cost of a specific installation d) Install temporary service (<i>Articles 590.4</i>) e) Inventory equipment, materials, and supplies f) Mark location of switches and outlets on studding g) Locate room center for ceiling outlets h) Mark location of single system components i) Layout and install single and ganged boxes both flush and surface mounted (new construction) (<i>Article 314.20</i>) j) Layout and install ganged boxes both flush and surface mounted (old construction) (<i>Article 314.20</i>) k) Install line and low voltage thermostats (<i>Articles 424.20</i>) l) Install radio, TV, and telephone outlets (<i>Article 314.1, 314.2, 720.11</i>) m) Install underground and overhead service entrances (<i>Article 230.2</i>) n) Install main distribution panel (<i>Article 110.26, 408.1</i>) o) Install circuits using non-metallic sheathed cable (<i>Article 334</i>) p) Install and connect branch circuit grounding (<i>Articles 210.5, 250.4</i>) q) Install power feeder wiring system to equipment (<i>Articles 215.1, 220.1, 225.11</i>) r) Install non-metallic conduits for above and below ground installation (<i>Article 352</i>) s) Install conductors in conduit or raceway and terminate (<i>Articles 310, 314.1</i>) t) Install underground cable (<i>Article 340.10</i>) 	

- u) Install wire terminals and lugs (*Articles 110.14*)
- v) Make splices using approved methods (*Article 110.14*)
- w) Install flexible and liquid tight conduit (*Articles 348.1, 350.1*)
- x) Install, identify, and label circuit breakers, fuses, and fuse adapter in distribution panels (including AFCI breakers)
- y) Test circuits for proper operation
- z) Install lighting dimmer systems (*Article 404.14*)
- aa) Install switches - single pole, three-way, and four-way (*Article 404.2*)
- bb) Install duplex and special purpose receptacles (including GFCI) (*Article 210.18, 406.4*)
- cc) Install lighting fixtures (incandescent, fluorescent, LED, recessed and surfaced) (*Article 410*)
- dd) Install door chime, switches, and transformer (*Article 404, 450, 720*)
- ee) Connect automatic garage door opener
- ff) Install overhead fan or fanlight with controls (*Article 314.28*)
- gg) Connect or troubleshoot water heaters (*Article 422.10, 422.13*)
- hh) Install single-phase dual voltage motors (*Article 430*)
- ii) Test emergency lighting system
- jj) Complete an accident or incident report
- kk) Apply National Electrical Code (NEC) terms and concepts (*Articles 100*)
- ll) Summarize the NEC style (*Articles 90*)
- mm) Use formal methods in finding code requirements
- nn) Determine the purpose, scope, and enforcement of the NEC (*Articles 90*)
- oo) Examine the mandatory rules and formal interpretation of the NEC
- pp) Apply definitions for proper understanding and application of the NEC rules (*Articles 100*)
- qq) Examine working space and working space entrances for electrical equipment (*Articles 110.26*)

Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS EET 154/155

*CTSO--SkillsUSA

Electrical Construction II

460313

Course Description		
Expands the knowledge and skills needed to work in commercial and industrial construction wiring.		
Content/Process		
	<i>Articles are referenced from the latest version of the National Electric Code (NEC)</i>	
1	<p>Workplace Safety and Knowledge:</p> <ul style="list-style-type: none"> a) Identify equipment and materials of the trade b) Identify safe and proper use of tools of the trade c) Identify the characteristics of a safe work site d) Identify OSHA's 1926.10 Construction Standards and who enforces OSHA Rules and Regulation in Kentucky e) Identify and use personal protective equipment f) Demonstrate ladder safety g) Demonstrate electrical safety (i.e., GFCI, cord use, grounding) h) Identify different types of chemical, biological, and physical hazards i) Interpret hazardous chemical communication (i.e., MSDS, HAZWOPER) j) Demonstrate knowledge and understanding of blood borne pathogens k) Demonstrate knowledge and understanding of blueprints (i.e., symbols, specifications, layout) l) Demonstrate knowledge and understanding of schematics and line diagrams 	
2	<p>MATH AND SCIENCE OF ELECTRICITY:</p> <ul style="list-style-type: none"> a) Demonstrate an understanding of Ohm's Law b) Demonstrate an understanding of DC Circuits c) Demonstrate an understanding of AC Circuits d) Demonstrate an understanding of transformers 	
3	<p>WIRING METHODS AND MATERIALS - National Electrical Code Articles 300 – 399:</p> <ul style="list-style-type: none"> a) Exhibits previously learned knowledge of general wiring methods and materials b) Locates information using conductors for general wiring c) Demonstrates an understanding of conductors for general wiring d) Apply knowledge of outlet, device, pull, and junction boxes; conduit bodies; fittings; and handhole enclosures e) Apply knowledge of cables according to the National Electrical Code (320-340) f) Apply knowledge of raceways according to the National Electrical Code (342-399) 	

3	<p>EQUIPMENT FOR GENERAL USE - National Electrical Code Articles 400 – 490:</p> <ul style="list-style-type: none"> a) Interpret code regulations of equipment for general use (i.e., cords, switches, fixtures) b) Apply knowledge of luminaires, lampholders, and lamps c) Apply knowledge of appliances and equipment 	
4	<p>WIRING AND PROTECTION - National Electrical Code Articles 200 – 285:</p> <ul style="list-style-type: none"> a) Exhibits use and identification of grounded conductors b) Interpret code regulations of branch circuits c) Interpret code regulations of feeders d) Apply branch-circuit, feeder, and service calculations e) Interpret code regulations of services f) Calculate overcurrent protection g) Interpret code regulations of grounding and bonding 	
5	<p>GENERAL - National Electrical Code Articles 100 – 110:</p> <ul style="list-style-type: none"> a) Exhibits previously learned material by recalling facts, terms, and basic concepts related to the National Electrical Code b) Locates information using electrical installations regulation c) Demonstrates an understanding of electrical installations regulation 	
	<p>Electrical Construction II:</p> <ul style="list-style-type: none"> a. Install electrical metallic tubing (<i>Article 358</i>) b. Install under-floor raceways (<i>Article 390</i>) c. Install lay-in duct work (wireways) (<i>Articles 376, 378</i>) d. Run fiber optic cable in raceways (<i>Articles 770.24, 770.110</i>) e. Install rigid conduit (<i>Articles 344.10 through 344.60</i>) f. Install explosion proof fixtures and devices (<i>Article 501.15</i>) g. Install feeder busways (<i>Article 368.10 through 368.60</i>) h. Install plug-in busways (<i>Article 368.10 through 368.60</i>) i. Ground service to metallic bonding systems (<i>Article 250.94</i>) j. Draw external power diagrams k. Install intercom and public address systems (<i>Articles 800.18, 170, 110.3</i>) l. Install multi-conductor cables (<i>Article 250.119</i>) m. Install low-voltage lighting controls (<i>Article 411</i>) n. Install snow and ice melting equipment (<i>Article 426</i>) o. Connect emergency backup systems (rotary and solid-state types) (<i>Article 700</i>) p. Lace cable and wires in open raceways and control panels (<i>Articles 300, 336, 409</i>) q. Install photo-electric control (<i>Article 404.2 (C) 7</i>) r. Connect PC-based climate control equipment (<i>Articles 440, 750</i>) s. Install dynamic, switching, and resistive sensing devices t. Draw control panel diagrams u. Apply National Electrical Code (NEC) terms and concepts (<i>Article 100</i>) v. Summarize the NEC style (<i>Article 90</i>) 	

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| | <ul style="list-style-type: none">w. Use formal methods in finding code requirementsx. Determine the purpose, scope, and enforcement of the NEC (Article 90)y. Examine the mandatory rules and formal interpretation of the NECz. Apply definitions for proper understanding and application of the NEC rules (Article 100)aa. Examine working space and working space entrances for electrical equipment (Article 110.26) | |
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Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS EET 252/253

*CTSO--SkillsUSA

Circuits I

460316

Course Description		
Introduction to basic theory of DC and AC circuits, including circuit analysis techniques, introductory magnetism, and transformer principles.		
Content/Process		
1	<p>Workplace Safety and Knowledge:</p> <ul style="list-style-type: none"> a) Identify equipment and materials of the trade b) Identify safe and proper use of tools of the trade c) Identify the characteristics of a safe work site d) Identify OSHA's 1926.10 Construction Standards and who enforces OSHA Rules and Regulation in Kentucky e) Identify and use personal protective equipment f) Demonstrate ladder safety g) Demonstrate electrical safety (i.e., GFCI, cord use, grounding) h) Identify different types of chemical, biological, and physical hazards i) Interpret hazardous chemical communication (i.e., MSDS, HAZWOPER) j) Demonstrate knowledge and understanding of blood borne pathogens k) Demonstrate knowledge and understanding of blueprints (i.e., symbols, specifications, layout) l) Demonstrate knowledge and understanding of schematics and line diagrams 	
2	<p>MATH AND SCIENCE OF ELECTRICITY:</p> <ul style="list-style-type: none"> a) Demonstrate an understanding of Ohm's Law b) Demonstrate an understanding of DC Circuits c) Demonstrate an understanding of AC Circuits d) Demonstrate an understanding of transformers 	
3	<p>WIRING METHODS AND MATERIALS - National Electrical Code Articles 300 – 399:</p> <ul style="list-style-type: none"> a) Exhibits previously learned knowledge of general wiring methods and materials b) Locates information using conductors for general wiring c) Demonstrates an understanding of conductors for general wiring d) Apply knowledge of outlet, device, pull, and junction boxes; conduit bodies; fittings; and handhole enclosures e) Apply knowledge of cables according to the National Electrical Code (320-340) f) Apply knowledge of raceways according to the National Electrical Code (342-399) 	

4	<p>Circuits I:</p> <ul style="list-style-type: none"> a) Demonstrate an understanding of resistance, capacitance, and inductance b) Explain simple DC voltage and current divider circuits c) Demonstrate an understanding of Ohm's law and be able to perform a basic calculation d) Solve simple time-constant circuits, both R-C and R-L e) Use Kirchoff's Laws to analyze DC circuits f) Solve series and parallel DC circuits g) Understand basic theory of and applications to electric circuits for Series Circuits, Parallel Circuits, and Series-Parallel Circuits h) Demonstrate an understanding of basic transformers i) Demonstrate basic soldering skills j) Exhibit verbal and written communication skills through teamwork and technical reports k) Demonstrate an understanding of basic electrical measuring instruments such as those used for: voltage measurement, current measurement, and resistance measurement l) Demonstrate proficiency in the use of common electrical laboratory instrumentation m) Demonstrate an understanding of electrical safety principles n) Describe the use of hand tools and basic test equipment o) Demonstrate an understanding of basic magnetism and AC principles 	
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Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS ELT 110

*CTSO-- SkillsUSA

Circuits II

460319

Course Description	
Complex alternating current and direct current circuits. Emphasis is on impedance, reactance, power and electrical energy, electrical measurement instruments, and circuit analysis.	
Content/Process	
1	<p>Workplace Safety and Knowledge:</p> <ul style="list-style-type: none"> a) Identify equipment and materials of the trade b) Identify safe and proper use of tools of the trade c) Identify the characteristics of a safe work site d) Identity OSHA's 1926.10 Construction Standards and who enforces OSHA Rules and Regulation in Kentucky e) Identify and use personal protective equipment f) Demonstrate ladder safety g) Demonstrate electrical safety (i.e., GFCI, cord use, grounding) h) Identify different types of chemical, biological, and physical hazards i) Interpret hazardous chemical communication (i.e., MSDS, HAZWOPER) j) Demonstrate knowledge and understanding of blood borne pathogens k) Demonstrate knowledge and understanding of blueprints (i.e., symbols, specifications, layout) l) Demonstrate knowledge and understanding of schematics and line diagrams
2	<p>MATH AND SCIENCE OF ELECTRICITY:</p> <ul style="list-style-type: none"> a) Demonstrate an understanding of Ohm's Law b) Demonstrate an understanding of DC Circuits c) Demonstrate an understanding of AC Circuits d) Demonstrate an understanding of transformers
3	<p>Circuits II:</p> <ul style="list-style-type: none"> a) Explain the design of complex DC and AC series, parallel, and series/parallel circuits b) Use Thevenin, Norton, Loop, and Mesh analysis and superposition to solve AC and DC circuits c) Demonstrate an understanding of AC power, electrical energy, and power factor correction d) Demonstrate an understanding of transformers, 1- and 3- phase e) Exhibit a working knowledge of phasors and complex numbers (polar and rectangular forms) f) Explain the design of simple low-pass, high-pass, and band-pass passive filter circuits g) Demonstrate a working knowledge of 3- phase AC h) Exhibit verbal and written communication skills through teamwork

	and technical reports i) Demonstrate an understanding of Resonance in AC circuits	
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Connections:

*Common Core State Standards

*KOSSA

*Common Core Technical Standards

*New Generation Science Standards

*Post-Secondary: KCTCS ELT 114

*CTSO--SkillsUSA